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NOVEMBER, 1918

No. 5

# ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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VALUE AND LIMITATIONS OF LABORATORY STUDIES OF ACIDOSIS IN SURGERY . . . . .	457
GEORGE W. CRILE, M.D. . . . .	CLEVELAND
THE HOSPITALS OF THE AMERICAN EXPEDITIONARY FORCE . . . . .	463
CHARLES H. PECK, M.D. . . . .	U. S. ARMY
QUINO-FORMOL SOLUTION IN WAR SURGERY . . . . .	467
JAMES TAFT PILCHER, M.D. . . . .	BROOKLYN
HISTORY ANALYSIS APPLIED TO SURGICAL DISEASES OF THE BILIARY TRACT AND PANCREAS . . . . .	471
ALLEN O. WHIPPLE, M.D. . . . .	NEW YORK
CONTRIBUTION TO STUDY OF MYOSITIS OSSIFICANS PROGRESSIVA . . . . .	485
JULIUS ROSENSTERN, M.D. . . . .	SAN FRANCISCO
A RADICLUCENT SEMILUNAR SHADOW OCCURRING AS A CONSTANT FACTOR IN CASES OF SEVERE INTERMITTENT HEADACHE . . . . .	521
MERRILL MILLER, M.D., AND E. G. C. WILLIAMS, M.D. . . . .	DANVILLE
IMPORTANT POINTS RELATING TO THE SURGICAL TREATMENT OF PROSTATIC HYPERTROPHY . . . . .	522
ALBERT J. OCHSNER, M.D. . . . .	CHICAGO
THE AMBULANCE AIRSHIP . . . . .	526
NORVILLE WALLACE SHARPE . . . . .	ST. LOUIS
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY . . . . .	531
STATED MEETING, HELD OCTOBER 9, 1918.	
TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY . . . . .	538
STATED MEETING, HELD JANUARY 7, 1918.	
EDITORIAL COMMENT . . . . .	549
BOOK REVIEWS . . . . .	564
CORRESPONDENCE . . . . .	567

**J. B. LIPPINCOTT COMPANY, PUBLISHERS**  
MONTREAL      PHILADELPHIA      LONDON

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# ANNALS of SURGERY

VOL. LXVIII

NOVEMBER, 1918

No. 5

## THE VALUE AND LIMITATIONS OF LABORATORY STUDIES OF ACIDOSIS IN SURGERY

By GEORGE W. CRILE, M.D.

OF CLEVELAND, O.

It has been suggested that acute blood acidosis and diminished reserve alkalinity may be a cause of shock. If this is true—if shock can be attributed to an increased acidity of the blood—then it would be logical to conclude that alkalinization of the blood would cure shock.

To determine the basis for these assumptions an experimental research was undertaken in my laboratory in 1912 by Dr. M. L. Menten and later continued by W. J. Crozier, Ph.D., and Drs. W. B. Rogers, B. I. Harrison and R. E. Mosiman. The laboratory studies, which included observations of the H-ion concentration and of the reserve alkalinity of the blood of different kinds of animals under varied normal and abnormal conditions, were supplemented by clinical studies of human blood under normal and pathological conditions.

**H-ION CONCENTRATION.—Positive Laboratory Findings.**—In the work in collaboration with Doctor Menten, who had worked for a year with Michaelis and used his gas-chain method, we found that the H-ion concentration of the blood was increased: (1) During intense fear; (2) during intense rage; (3) during extreme exertion; (4) during inhalation anæsthesia; (5) in surgical shock; (6) in hemorrhage; (7) in asphyxia; (8) in alcoholic intoxication; (9) several hours after excision of the liver; (10) near the death point after excision of the adrenals; (11) near the point of dissolution whatever the cause of death.

**Negative Laboratory Findings.**—We found also that the H-ion concentration was *not* increased: (1) In narcosis by opium or its derivatives; (2) during sleep; (3) during protracted consciousness unbroken by sleep, until near the death point; (4) during the maintenance of artificial respiration in overtransfused decapitated animals; (5) in iodoform poisoning; (6) in serious, even fatal, diseases, such as infections, exophthalmic goitre, cardiovascular disease, typhoid fever.

**Morphine in Relation to Increased H-ion Concentration.**—When morphine in large doses was given during acute acidosis (indicated by increased H-ion concentration of the blood) the restoration of the blood to its normal reaction was interfered with, even prevented. For example, heavy doses of

morphine were given to a vigorous male cat, in which a markedly increased H-ion concentration had been induced by intense rage and struggling. The animal remained in acute acidosis for three and one-half hours and died in acidosis. In other experiments large doses of morphine interfered with the overcoming of the acidosis of inhalation anæsthesia. The ill effects of morphine in certain types of cyanosed patients is well known to clinicians.

→ *The exhausted and cyanosed patient should therefore not have morphine; but after the cyanosis has disappeared, morphine is most useful.*

In brief, we found that the H-ion concentration was increased in but two groups of cases: (1) Those subjected to excessive energy-transforming activities in which, apparently, the corrective mechanism could not dispose of the increased acid by-products as rapidly as they were produced; and (2) those in which the sufficiently rapid elimination of the acid by-products was prevented by interference with the corrective mechanism.

*Reserve Alkalinity and Acid Excretion in the Urine.*—With the exception of the above note regarding morphine, no clinical lead of value was secured from our studies of H-ion concentration. We therefore turned our attention to studies of the reserve alkalinity of the blood with the hope that by this means we might secure a true indication of the reserve vitality of a patient, which would determine the surgical risk. To this end we made numerous measurements of the reserve alkalinity of the blood by the Van Slyke method, and in both the laboratory and the clinic we repeated the studies of Professor Lawrence Henderson on the acid excretion in the urine.

Our experimental observations may be summarized as follows: In laboratory animals the reserve alkalinity of the blood was reduced and the acid excretion in the urine was altered in varying degrees by surgical shock, by anæsthesia, by infection, by asphyxia, by hemorrhage, by strychnine poisoning, by iodoform poisoning, by exertion, by emotion.

Measurements of the reserve alkalinity afforded more accurate information when the animals were subjected to an acute overwhelming drive with which the corrective mechanism could not keep pace.

The best estimation of the practical value of determinations of reserve alkalinity and of acid excretion was secured in the clinic. Here great and unexpected variations were found in acute infections, in late cancers, in desperate cases of exophthalmic goitre—in good and bad risks of all kinds. In cases of infection with grave prognosis which died later, and in other cases in which death was impending—not in the stage of dissolution but inoperable—the reserve alkalinity of the blood was sometimes found to be as great as in the observer, and the quantity of acid excretion in the urine was not materially disturbed.

The results of these series of laboratory studies force us to the reluctant conclusion that these methods, despite their scientific interest, as yet offer meagre clinical value; that is, that laboratory studies of the H-ion concentration, the carbon dioxide tension and the reserve alkalinity of the blood



## ACIDOSIS IN SURGERY

and of the acid excretion of the urine furnish no invariably reliable indication of the condition of the patient.

**INTRACELLULAR ACIDOSIS.**—During the past ten years cytologic studies on over 2500 animals and on many humans have been made by my associates, especially Dr. J. B. Austin. The following notes summarize our cytologic findings:

(a) In all cases of exhaustion, whatever the cause, provided the animal lived from four to eight hours after an adequate degree of exhaustion had been established, fairly constant cytologic changes were present in three vital organs—the brain, the liver and the adrenals, the changes in the liver and in the brain being more marked than those in the adrenals.

(b) Our research included studies of exhaustion from insomnia, from the emotions of fear and rage, from muscular exertion, from physical trauma (surgical shock), from infection, from hemorrhage, from asphyxia, from acute alcoholism, from ether anæsthesia, from anaphylaxis, from eclampsia. We studied exhaustion produced by the application of electric stimuli, by burns, by starvation, by the intravenous injection of acids, particularly hydrochloric acid, by excision of the liver, of the adrenals, of the thyroid, by the injection of foreign proteins, of fæces extract, of thyroid extract, of iodoform, of adrenalin, of strychnine, of chloretone. We studied also the exhaustion of salmon at the headwaters of the Columbia River in the spawning season, and of electric fish and eels after electric discharge. All of these studies were compared with parallel observations made on normal and on hibernating animals.

Our findings may be summarized as follows:

(a) The cytologic changes in the brain, the liver and the adrenals roughly parallel the clinical phenomena.

(b) When intracellular oxidation is excessive, as in extreme muscular exertion, intense emotion, physical injury, infection, after the injection of iodoform, strychnine, thyroid extract, etc., then an excessive amount of acid by-products will accumulate in the cell; and, as Loeb, Clowes, and others have shown, when the cell becomes acid it will accumulate water and swell and will take normal stain less well. If other conditions are normal, but there is a lack of oxygen, as in asphyxia, in hemorrhage, and after adrenalectomy, the physiologic balance will be disturbed, and a like swelling will occur. After the injection of an acid or the establishment of an acid state by chloretone, alcohol or ether, the cells swell. In brief, any one of the causes of exhaustion may produce the same end-effect—intracellular acidosis with a suspension of function according to the degree of exhaustion produced.

(c) The cytologic lesions produced by exhaustion from any cause are repaired only during sleep. If sleep is abolished, repair cannot take place, the cells remain acid, and death follows.

**INTRACELLULAR PROBLEMS.**—Since the balanced state of the cell is attained only during the normal supply of water and food, the rhythmic alterna-

tion of consciousness and sleep, and normal oxidation, it is obvious that the solution of the problem is not as simple as the neutralization of the acidity of a fluid in a test-tube by pouring in alkalis. It is necessary not only to get rid of the acids, but also to establish the conditions required for continued oxidation within limits consistent with the maintenance of the life of the cell.

**ALKALINITY AND ACIDITY IN RELATION TO ANIMAL LIFE.**—The origin of life was probably in the sea. The sea is alkaline. Animal life is continued only in an alkaline medium. When the blood becomes acid, life ends. As transformers of energy, animals are constantly producing acid by-products. The acid by-products vary according to the rate of energy transformation, *e.g.*, they are increased by muscular exertion, by emotion, by fever, etc. Therefore the organism is constantly in danger of killing itself; and many animals and men have killed themselves by their excessive production of acid by-products. For example, in intense muscular struggles the acid-production is so great and so rapid as to overcome the factors of safety, *i.e.*, the lungs, the liver and the buffer substances—the reserve alkalis immediately available.

One would suppose, therefore, that during the vast selective struggles of animals, wide margins of safety must have been developed in these corrective mechanisms as a means of immediate protection against a sudden emergency, *e.g.*, the acute acidosis of muscular, emotional and fever crises. In the fluids and tissues of the body, also, have been stored large reserves of bases and alkalis to be more gradually drawn out in prolonged struggles, prolonged want of food and water, prolonged fever, etc.

Our studies of the H-ion concentration of the blood supported this biologic conception; for we found that the factors of safety were overcome only by an intense drive, and that after the termination of the intense drive the normal H-ion concentration was quickly re-established, although clinically the animal was fatigued.

**LIMITATIONS OF LABORATORY METHODS.**—Our H-ion determinations, therefore, showed only the degree of failure of the corrective mechanism, but did not inform us to what degree the reserves had been called out, nor how wide was the remaining margin of safety.

Estimations of the reserve alkalinity told us what reserves the blood contained at the particular time the estimations were made, but gave no information regarding the amount of reserves stored outside the blood—in the other body fluids and tissues.

An attempt to secure information by these methods is comparable to an attempt to determine the wealth of a man by counting the ready money in his pockets (H-ion concentration), and from this amount estimating his ready available cash reserve in the bank (reserve alkalinity), and in turn estimating his ultimate financial resources from the amount of his bank balance, without taking into consideration the securities he might hold in his strong-box (ultimate reserves).

## ACIDOSIS IN SURGERY

A man may be financially embarrassed if his immediate cash is expended; he is not bankrupt until his ultimate reserves are exhausted.

So the scientific methods thus far devised give us the extent of the margin of safety in the blood at the moment the observation is made, but they do not inform us of the condition of the reserve factors of safety. In other words, our present laboratory methods do not tell the whole truth regarding the actual state of the patient.

VALUE OF CLINICAL OBSERVATIONS.—To what extent can we depend upon the clinical phenomena of acidosis as a means for estimating the reserve factors of safety? In this respect, what is the significance of changes in the respiration and pulse, of thirst, of pallor, of cyanosis, of collapsed facies?

*Respiration.*—The respiratory centre consists of nerve cells and fibres, and these cells are modified by every phase of chemical changes in the blood. The respiratory centre, therefore, responds with infinite accuracy to every change in the acid content of the blood—is governed by the H-ion concentration of the blood. This mechanism of surpassing fineness and accuracy not only reacts to intracellular acidosis but fulfils that function so correctly as to preserve life and health. Of such vital importance is its function that this delicate living mechanism is located in the seat of life itself, while the man-made laboratory mechanisms are not only infinitely more clumsy and inaccurate, but are outsiders. The respiratory centre responds to every phase of acidosis—to the acidosis of asphyxia, of hemorrhage, of emotion, of exertion, of acid injections, of anaesthesia, of injury, of starvation—the entire gamut. It not only responds accurately, but its response is dramatically staged so that not only the trained professional eye, but the bystander, even the patient himself, cannot escape its obtrusive evidence.

The nerve cells of the respiratory centre are not the only nerve cells that are modified by acidosis; the cells that fabricate muscular and mental action are modified also, their power to do work is diminished. This is an essential protective adaptation, for if the activity of these cells were increased in proportion to the increase of the activity of the nerve cells of the respiratory centre, then the amount of muscular work and the consequent production of acid by-products would be increased, and certain disaster would result. Hence we have *increased* respiratory action, and *diminished* muscular action—a *corrective antithesis*.

*Circulation.*—Why does the heart beat more rapidly in acidosis? The biologic interpretation would be that this reaction was evolved as a protective adaptation in order that the blood might circulate more rapidly and thus more efficiently serve those cells of the body whose activity is essential to life.

The low blood-pressure, on the other hand, is not a corrective adaptation but, rather, it indicates the failure of the circulatory mechanism, which adds a damaging anaemia to the vicious circle of approaching disaster.

*Perspiration.*—Sweating is not only a corrective mechanism for the elimination of the heat incident to the increased energy transformation in exertion, emotion, etc., but it is also a vehicle for the elimination of the acid by-products.

GEORGE W. CRILE

*Thirst.*—The demand for water is an adaptation purposed to increase the supply of the most efficient means of diminishing acidity—water.

*Pallor.*—The patient grows pale because the circulation is failing and blood is no longer sent to the skin in excessive amounts as during the driving phase of excessive energy transformation in emotion, exertion, etc.

*Cyanosis.*—The nails become blue because the circulation is failing and the blood is not being oxidized.

*Collapsed Facies.*—Because of the loss of power of the muscles of expression, the features assume the appearance which is characteristic of exhaustion, and in varying degrees is seen in sleep, in anæsthesia, in death.

**CONCLUSIONS.**—As a result of these studies we are forced again to admit that no laboratory conclusion should be considered valid until it has been tested in the crucible of the clinic.

In the problem of shock—exhaustion—the success of such restorative measures as oxygen, the intravenous injection of sodium bicarbonate with glucose and, above all, sleep—deep, untroubled sleep—lend support to the laboratory conception that acidosis—intracellular acidosis—is the fundamental condition present in exhaustion from any cause.



## THE HOSPITALS OF THE AMERICAN EXPEDITIONARY FORCE\*

BY COLONEL CHARLES H. PECK, M. C., U. S. ARMY

FORMERLY SENIOR CONSULTANT, DIVISION OF GENERAL SURGERY, A. E. F.

THE care of the wounded from the trench or field to the front line hospital falls upon the Division Surgeon and his staff medical officers and enlisted men. Beside the Chief and his assistants on the Administrative Staff, these constitute the personnel of field hospitals, ambulance companies; Regimental and Battalion Surgeons for the regiments of infantry and artillery, stretcher bearers, ambulance drivers and hospital corps men.

It is needless to say that much depends on the experience, foresight and judgment of the Division Surgeon. The choosing of sites for aid-posts and dressing stations, of routes of evacuation for the stretcher bearers and ambulances, instruction of officers and enlisted men, of ambulance companies and field hospital personnel in their duties; the perfecting of plans for rapid evacuating of wounded to properly equipped operating hospitals; the establishment of special hospitals for the care of gas casualties, are all of prime importance.

The fate of the wounded man depends first on the care and skill with which these duties are performed, and to perform his duty efficiently, the Division Surgeon must have the confidence and coöperation of his commanding line officer, and warning of impending attacks in order to make adequate preparation. There must be an ample supply of surgical dressings and of splints at all aid-posts and dressing stations, and provision for applying heat and warm dry blankets in the treatment of shock. Splints must be furnished to stretcher bearers to apply to fracture cases where they fall. Each division in action should have an ample supply of the standard adopted splints, such as Thomas leg and thigh splints, Thomas arm splints and Cabot posterior wire leg splints, and all stretcher bearers and hospital corps men should be thoroughly instructed in their application.

Of the hospital corps men in the division about 60 per cent. are available as stretcher bearers. These should be supplemented by additional combat men from each of the line regiments, designated and instructed to act as supplementary stretcher bearers in case of need during an offensive.

The treatment of the wounded man from the time he falls until he reaches the evacuation hospital consists in the control of hemorrhage, the application of first-aid dressing, the application of splints, the treatment of pain and shock at the aid-post or dressing station (Fig. 1), by morphine, heat, hot drinks with bicarbonate of soda, and, if needed, blood transfusion or gum infusion, or rest for a time before being sent back in an ambulance; antitetanic serum must also be given. It is of the greatest importance

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\* Read before the New York Surgical Society, October 9, 1918.

that the wounded should reach the operating hospitals within eight or ten hours after injury, so that operation may be performed before infection has become established. It is then possible in a good percentage of cases to prevent infection by careful débridement and closure of the wound by primary or delayed primary suture. All war wounds, especially those due to shell fragments (generally at least 80 per cent. of the total), are potentially infected, and unless the missile with fragments of clothing is removed and the contused tract excised, suppuration, gas gangrene, or serious sepsis in some form is almost sure to develop. If operation is delayed for twenty-four hours or more, it is necessary to leave the wound widely open and overcome the infection by the Carrel-Dakin treatment or some form of chemical disinfection; as a rule, closing the wound by secondary suture, when bacterial counts show it to be practically germ free. This always means delayed convalescence, often increased scar tissue, and greater impairment of function, to say nothing of loss of life or limb from uncontrollable sepsis, as compared to results obtained by earlier operation.

The importance, therefore, of a system of transport and evacuation of wounded and of properly equipped and manned operating hospitals near the fighting line, which will permit of early operation, cannot be overestimated.

The field hospital is an integral part of the division, moves with it wherever it goes, and should not be used as an operating hospital for battle casualties, except in emergencies where it has been impossible to establish an operating hospital sufficiently near the line.

The field hospital should take care of the sick, contagious, minor accidents, neuroses, venereal and skin diseases. One of the four may well be organized for the treatment of gas cases, as has frequently been done, for provision must be made for handling large numbers of this type of casualty rapidly. Another may be used to supplement the capacity of a mobile operating hospital serving the division in time of stress, as was done in the 42nd Division during the July offensive near Chalons, and the 1st Division at Cantigny.

The hospitals in which the vast majority of war wounds are operated upon are placed, as a rule, from 8 to 12 miles back of the line, and are not attached to a division, but rather serve a sector. They are of two types—(a) the evacuation hospital (the prototype of which in the French service is the H. O. E.; in the British service, the casualty clearing station), and (b) the mobile hospital, or *autochir* of the French. The latter may be attached to and form a part of an evacuation hospital, or may operate independently as an advanced hospital for non-transportables.

For more than two years, up to the spring of 1918, the French had been developing a highly organized line of evacuation hospitals (Figs. 4 and 5), from west of Compeigne to the Vosges, many of which had a capacity of from 2000 to 3000 patients. They were furnished with the best of surgical equipment, and manned by the ablest operating surgeons in France. The permanent staff of these hospitals was supplemented, in time of battle, by large



FIG. 1.—Battalion aid post. Underground in a forest.



FIG. 2.—Mobile Hospital No. 2, A. E. F., showing Bessonneau tents (capacity 200).

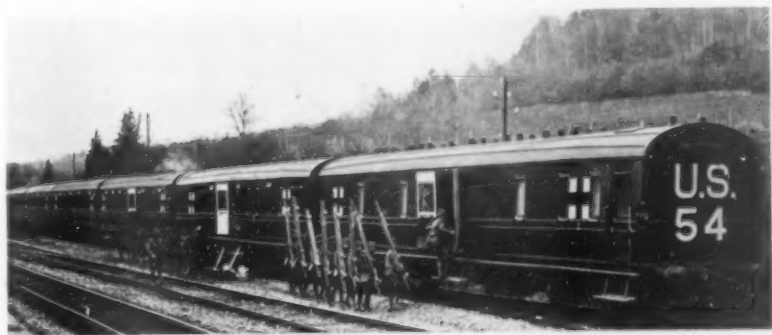


FIG. 3.—New hospital train, A. E. F. (sixteen cars, capacity 350 to 550 patients).



FIG. 4.—General view of Evacuation Hospital No. 2, A. E. F. Two-story military barracks (capacity about 1000).



FIG. 5.—A ward building of Evacuation Hospital No. 1, A. E. F. One-story military barracks (capacity about 1000).





FIG. 6.—Old monastery, now occupied by Base Hospital No. 3, A. E. F. (capacity about 1700).



FIG. 7.—Partial view of Base Hospital No. 15, A. E. F. Artillery barracks, two-story type (capacity about 2500).



FIG. 8.—Base Hospital No. 6, A. E. F. Group of newly built barracks for expansion, main hospital in an old school building (capacity 2200 beds).



FIG. 9.—Base Hospital No. 27, A. E. F. Old college building and courtyard (capacity about 2000).



FIG. 10.—Base Hospital No. 36, A. E. F. One of five summer hotels used by hospital (capacity about 1800).

## HOSPITALS OF THE AMERICAN EXPEDITIONARY FORCE

numbers of mobile operating teams, which were sent from one part of the line to another as times of stress developed or were anticipated. In a hospital of this type where I worked for several weeks during such a period, as head of an American operating team, there were twelve teams to each service of 1000 patients, or thirty-six in the entire hospital. These teams worked in eight-hour shifts, night and day, during the height of the offensive. The result of this organization was that all patients were operated upon without delay, and the best possible surgical results were obtained. In addition to the large evacuation hospitals, there were smaller mobile hospitals (Fig. 2) nearer the line, in which some of the graver non-transportable cases, *e.g.*, injuries of the head, abdomen and thorax, severe multiple injuries, were operated upon and kept until they could be more safely transported, and moribund cases were cared for until they died. During this period, great advances were made in the methods of treatment and results, and the principles of early, thorough débridement, and primary and delayed primary suture, were developed with brilliant results. No such results would have been possible had the operative work been done in hospitals not thoroughly equipped and manned for major surgical work. It was demonstrated that war-wound surgery demanded the highest degree of operative skill, that it is no work for a novice, and that results were successful in proportion to the ability and training of the surgeon.

Unfortunately, the success of this system of highly organized hospitals depended on a relatively fixed fighting line, and the great German drives of March and May swept away many of these splendid hospitals.

Our own service has adopted the plan of establishing evacuation hospitals near the line, and Evacuation No. 1 and No. 2, organized in the early spring, have been doing excellent work. Surgical teams headed by some of the best of our surgeons in France are in charge of the work and results have been most gratifying. Under the supervision of Colonel J. M. T. Finney (now Brigadier General), Chief Consultant, Surgical Service, A. E. F., and his staff of consultants, the professional work has been developed and standardized. Ideas from the best methods of the French, British and Belgian services have been incorporated into our own procedure.

Additional mobile surgical teams with carefully selected operators, many of whom had had a period of observation and training in these hospitals, were being rapidly formed and sent to the front as new evacuation hospitals were established. Three mobile hospitals had been organized, others were being assembled, and from 75 to 100 will probably be in active operation before next summer. Our units are to be kept smaller and more mobile, for adaptation to the rapid changes in the line which have been the feature of the summer campaign of 1918.

Seventeen splendid hospital trains (Fig. 3) were in operation for evacuation of the wounded to the base hospitals of the interior, and at least 50 will soon be in use. They are 16-car trains with a capacity of 360 stretcher cases, or up to 550 sitting patients.

A line of thoroughly organized base hospitals (Figs. 6-10) extends from northeastern France to the Brittany coast. These are established in buildings of three general types, *i.e.*, military barracks, summer hotels and large schools or colleges. Additional bed space is usually obtained by newly built barracks of wood, brick or concrete, and the capacity of each unit varies from 1000 to 2500 beds. In addition to those already established, there were ten large base hospital centres under construction, each to have from 5000 to 30,000 beds, some nearly completed, all well under way. The number of base and evacuation hospitals in France has been greatly increased since midsummer.

Patients are moved from the evacuation hospital back to the base hospital by hospital train as soon as they can travel safely; slight and moderate wounds within a few hours or a day or two; severe cases being often kept from one to two weeks. It is estimated that from 70 per cent. to 80 per cent. of all casualties are able to return to duty within two months.

Large convalescent camps or departments are being established in connection with all base hospital centres in the proportion of one bed to five, so that patients may be given graduated work, exercises or drill before returning to full duty. Thus a centre with 20,000 hospital beds will have accommodation for 5,000 convalescents. Base Hospital No. 8 has a farm of 100 acres devoted to this purpose. Patients likely to require more than four months' treatment, for return to either full duty or some useful service in the rear, will generally be sent to the United States as soon as they can safely travel.

The Medical Department of the American Expeditionary Force, with the cordial support of the Department in the United States, directed by the master minds of Surgeon General W. C. Gorgas and Chief Surgeon, A. E. F., General Merritt W. Ireland, has accomplished a gigantic task during the past fifteen months and has established a system of hospitals manned by the ablest surgeons our country has produced, many of national and international reputation, which will guarantee the best possible surgical treatment to our wounded, who fall in the battle line in France.

The illustrations show examples of battalion aid posts, mobile, evacuation and base hospitals, and hospital trains, and some of the various types of housing and shelter in use.



## QUINO-FORMOL SOLUTION IN WAR SURGERY

A PRELIMINARY REPORT \*

BY JAMES TAFT PILCHER, M.D.

OF BROOKLYN, NEW YORK

MAJOR M. C., U. S. A.

THE formulation of this solution was undertaken because the following observations had been noted in practical hospital work:

1. That Dakin's solution was not stable.
2. It was difficult to prepare and standardize properly.
3. It frequently irritated, probably because of its improper preparation.
4. The protection of the skin took time and material.
5. The prescribed strict and rigid formula for its application has until now not been found feasible to effect any further forward than at a base. The severe infections of war wounds are usually firmly established before its application is begun.
6. The slimy discharge, caused by serous exudate and cell detritus, by covering over the tissues, appeared to us to militate against the action of germicidal agents on bacteria present in the wound.
7. This discharge effectually prevented the dressings from absorbing the wound secretions.
8. The wound secretions in many instances appeared to become locked up, and toxic absorption therefore unquestionably increased.

Feeling, however, that there was a mechanical, as well as a chemical problem to be met, the observations of Colonel Wright and Major Taylor were thoroughly reviewed and considered; that of the former to deplete the greatly swollen tissues and cause a positive flow of fluid into the wound, and that of the latter because of its seeming analgesic effect on the raw surfaces, in addition to its bactericidal properties. An attempt was further made to enhance this germicidal action, and, in addition, to prevent the mass disintegration of partially devitalized tissues so commonly noted, and thus minimize the toxæmia by preventing the production of this most suitable media.

A solution to meet these difficulties seemed desirable; one that would be simple of preparation, stable, one that could be concentrated for transportation, the strength of which could be easily increased or diminished and one

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\* Read before the Research Society of the American Red Cross in France, Paris, France, September 6, 1918.

# JAMES TAFT PILCHER

that could be used in an early stage of wound treatment, namely at the field or evacuation hospital.

This was apparently accomplished by the following formula:

Quinine sulphate .....	1 gm.
Hydrochloric acid .....	.50 c.c.
Glacial acetic acid (99 per cent.) .....	5.00 c.c.
Sodium chloride .....	17.50 gm.
Formol (40 per cent.) .....	1.00 c.c.
Thymol .....	.25 gm.
Alcohol (90 per cent.) .....	15.00 c.c.
Aqua q. s. ad .....	1 liter

(1) Dissolve the quinine in the hydrochloric and acetic acids. (2) Dissolve the sodium chloride in the water. (3) Dissolve the thymol in the alcohol. Add No. 1 and No. 2, then the formol, and finally the thymol solution. The solution is best applied as directed for the use of the Carrel-Dakin solution, or may be injected through the Carrel tubes every two hours, or more frequently if necessary, to keep the wound bathed with it.

The hydrochloric acid, as noted in the formula, is used to put the quinine in a more perfect solution; the acetic acid for its action with the quinine solution, giving a solvent and analgesic effect; the sodium chloride for its dehydrating properties; the formol for its bactericidal and fixing properties, as is the alcohol, which is used to get the thymol into solution.

To test its efficacy it was employed on one hundred cases of severely infected wounds at the American Red Cross Military Hospital No. 5, mostly compound comminuted fractures, which had been treated for ten days to two weeks or longer with Dakin's solution, and in which the bacterial flora showed no signs of diminution in the great majority of instances. Bacterial counts and cultures demonstrated pure and mixed infections of the Welch bacillus, pneumococcus, streptococcus, Friedlander, staphylococcus, etc., in the following list of injuries:

## Compound comminuted fracture:

Femur .....	18
Humerus .....	11
Tibia .....	11
Fibula .....	3
Astragalus .....	1
Tarsal bones .....	2
Metatarsal bones .....	1
Patella .....	6
Acromion .....	2
Scapula .....	1
Radius .....	2
Ulna .....	3
Skull .....	1
Pelvis .....	1
Ribs .....	1
Osteo-arthritis G. S. W. knee-joint .....	8

## QUINO-FORMOL SOLUTION IN WAR SURGERY

Perforating G. S. W. with foreign bodies:	
Thigh .....	10
Leg .....	5
Abdomen .....	2
Chest .....	2
Arm .....	4
Neck .....	1
Amputation (G. G.):	
Leg .....	3
Arm .....	1
<hr/>	
Total .....	100

The essential procedure previous to the application of any antiseptic solution is the institution of adequate surgical measures as pointed out by Dépage; an extensive débridement, esquilectomy and removal of fragments. It is only as an adjuvant to the above that these chemico-mechanical solutions should be used, and unless thorough and painstaking surgery is accomplished, according to generally recognized principles, no one can possibly expect any results from the subsequent wound lavage with any solution. It might be argued, therefore, that those who have not met with marked success in the use of such treatments as those offered by Carrel-Dakin may not have appreciated the importance of this essential principle.

With this in mind the following observations are offered for confirmation, hoping that we may, by development and suggestion, evolve for the early and immediate treatment of these wounds an adjuvant which, by virtue of its properties of stability, non-irritability, ease of preparation, simplicity of ingredients, and the feasibility of concentration, will lend itself to the emergencies ever present in the zone of the advance, more essential the further forward one is, and most necessary at the very place where its best work may be accomplished—at the field hospital, and where the refinements of the preparation of Dakin's solution and its proper administration are impossible.

(1) Quino-formol is actively inhibitive and destructive to aërobic and anaërobic bacteria and protozoa, and can be utilized in field hospitals.

(2) The degree of irritation caused by it is insignificant, even over long periods of time.

(3) It is a stable solution, easy of preparation and mildly deodorant.

(4) It may be concentrated, or the normal strength solution may be increased in any of its constituents, without detriment to the other ingredients.

(5) There is a very definite flow of fluids from the tissues into the wounds, with consequent depletion and dehydration of the engorged areas, due to the hypertonicity of the solution and rapid relief of the neurovascular system, encroached upon by the swollen tissues, therefore tending to relieve the distal ischæmia and consequent impending gangrene, as well as the relief of local pain due to the great engorgement.

(6) There is an apparent analgesic effect on the exposed surfaces and

JAMES TAFT PILCHER

the dressings are remarked to be less painful; certainly the gauze is more easily removed and is noted to be impregnated to a much greater degree by the wound secretions than was the case where other solutions had been employed.

(7) The formol, synergized by the alcohol content, is believed to render the tissues less susceptible of bacterial invasion, owing to their slight hardening and fixing properties, thus diminishing the formation of suitable culture media.

(8) The acetic acid, in conjunction with the increased flow of serum into the wound, apparently acts as a definite solvent and cleansing agent, causing the secretions to be entirely absorbed by the dressings, and therefore favors more direct action of the antiseptics on the tissue surface and on the germs free in the wound.

(9) The muscles appear to be more firm and of deeper color. The wounds in many instances have been exceptionally dry.

(10) Epithelialization is apparently greatly stimulated, and is not of the anemic type noticed with Wright's solution.

(11) The normal coagulation time of the blood is practically unchanged or but very slightly retarded.

(12) The solution has no proteolytic properties, and when "felting" or deposition of fibrin is noted, Dakin's solution has been administered until the wound is clear of detritus. This has been found to be a most important and essential adjunct in the ultimate treatment.

(13) There has been a marked pronounced drop in temperature and pulse in many cases on changing from Dakin's to quino-formol, without any attendant operative procedure.

(14) Some wounds showing a count of 10 to 15 bacteria per field have been apparently rendered free from germs within three days. That is to say, none have been found in the repeated examination of 15 fields.

(15) Thirty consecutive cases treated within thirty-six to forty-eight hours after receipt of injury, on whom pre-operative smears were made and the presence of infection established, were rendered sterile within forty-eight hours and have continued to show absence of any bacteria on repeated counts subsequently, with one exception.

The bacterial counts and their attendant preparation have been personally accomplished by Lieutenant Coward, and the experimental investigation has been carried on by Lieutenant Wells. The supervision of the preparation of "quino-formol" has been under the direction of Lieutenant Ernest Martlew, Pharmacist at A. R. C. M. H. No. 5.

These observations are not entirely personal, but represent the experience of a number of surgeons at the American Red Cross Military Hospital No. 5, and have been controlled in many instances by Major George de Tarnowsky, under whose direction this research has been made and through whose courtesy, in affording me material, the above notations have been made possible.



## HISTORY ANALYSIS APPLIED TO SURGICAL DISEASES OF THE BILIARY TRACT AND PANCREAS \*

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IN recent years scientific clinical research has emphasized the supreme importance of an accurate history in making a differential diagnosis of the lesions of the upper abdomen. By many eminent surgeons the history is placed above physical signs, laboratory and X-ray findings in the order of their importance in determining the lesions of the biliary tract, yet there is lacking in the record systems of the majority of our hospitals any accurate or comprehensive method of eliciting the data desired and of analyzing such data even when available. The efforts of able and honest surgeons to collect and correlate their data are constantly thwarted by a lack of a comprehensive and accurate record system, and the published writings of many investigators are based upon inaccurate and insufficient data for the same reason.

It was the desire to obtain facts in the study of surgical diseases of the biliary tract that led the author to formulate the history analysis which is here reproduced. The faults in it are many, and many points of information may have been omitted. The analysis is being changed as new ideas are suggested. The point is that the cases in which the analysis has been carried out have afforded a basis for accurate deductions, as compared to the mere impressions that one gains from a study of the average hospital histories in a corresponding number of cases.

The term "history" is here used in its broadest sense. It includes the anamnesis, the physical examination, the laboratory and clinical findings, the discussion of the pre-operative diagnosis, the pathological reports, the notes on the post-operative course and complications, the discussion of the case by the operator and house surgeon; in case of death, the autopsy report and an analysis of the cause or causes of death, and, finally, but most important, the follow-up notes made at the time of subsequent visits or communications from the patient. Included in these follow-up notes there should be a statement, after each visit, of the result of the therapy based upon the anatomical, symptomatic and economic condition of the patient, *i.e.*, a true interval result.

But to have a uniform and inclusive analysis of the histories of a group of cases, it is essential that a comprehensive and detailed chart analysis be

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\* Read before the New York Surgical Society, May 8, 1918.

filled out while the patient is under observation. This chart should not take the place of the history, but should be filled out after the diagnosis is established and while the facts relating to the case are fresh in the mind of the observer or observers and obtainable from the patient and those connected with his case. It is a deplorable fact, realized by every surgeon who has tried to analyze a group of cases he was interested in, that only a small percentage of the desired information can be obtained from histories as they are taken by inexperienced internes in the average up-to-date and otherwise efficiently run hospital. It is also deplorable that not a little of the information contained in current literature of a clinical nature is based upon this inaccurate type of history analysis. Great credit is due to the staff of the Mayo Clinic for the practical and thorough work that they have done in establishing their history analysis system, notably in the diseases of the thyroid gland.

Certain features of a hospital record system are essential to the honesty and success of any history analysis and the conclusions based upon such an analysis. These should be discussed at this point:

1. There should be a complete and inclusive analysis chart, drafted by a member of the attending staff interested in and intensively studying the cases to be analyzed. He should supervise and check up the work of the interne staff and should review all the charts, if possible, before the patient leaves the hospital. Before deciding definitely to adopt an elaborate chart, for the analysis of cases over a certain period, it is wise to test out such a chart on fifty or more histories. In this way experience will add to the value of the analysis chart and certain details which will be found impractical or unnecessary will be eliminated. Others will be found of more importance than was expected. If the subject to be analyzed is a large one, or an inclusive one, such as surgical diseases of the biliary tract, it is of great advantage to have the histories of certain subdivisions, such as acute cholecystitis, common duct stone, carcinoma of the pancreas, grouped together on the unit sheets so that the summaries will cover definite groups of cases; at the same time these divisions will not affect the totals for the entire subject.

It has been very instructive to the writer to note that in the carefully analyzed cases, certain long-favored and deep-rooted "impressions"—acquired from text books, collateral reading or emphatic statements of famous clinicians—were proved doubtful by the recorded facts. Thus the percentage of cases giving a history of typhoid fever or showing a bacillus typhosus in the culture of the bile from the gall-bladder proved to be much lower than that mentioned by many writers. On the other hand the involvement of the pancreas in gall-bladder disease, as noted at time of operation, was much more frequent.

2. Of inestimable value is the unit history system, in which all notes relating to the case, from the time of admission to any part of the hospital, out-patient or in-patient, including follow-up notes, until the patient is lost track of, are recorded in the same folder or cover. All notes made on sub-

## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

sequent admissions to medical or surgical services, to the out-patient department or to the follow-up clinic are added to the original history. It is in a true sense a continuous and continuing record of that individual. Only those who have tried history analysis with the old-time bound volumes, bulky and deplorably incomplete, and who have later used the unit history can appreciate the advantage of the data all collected in one cover or folder. These folders or bindings are easy to handle, the analysis charts are filled out and included in the history and all the follow-up notes are to be found at the end of each admission to the hospital.

3. Equally important is a comprehensive and strictly supervised disease classification file, that makes it possible to record and to find easily all the cases under definite diagnoses, together with associated or accompanying conditions. Without such a system many cases of a certain disease or lesion will be lost because of inaccurate filing, or because they may be filed under various diagnoses. It is absolutely essential that all diagnoses in the histories conform to the terminology in use in the hospital. New terms may be added to the terminology by consent of the record room committee. Dr. Adrian Lambert has elaborated the terminology, worked out by himself and Dr. Walton Martin in 1910, and has made it the key to the record system at the Presbyterian Hospital. The disease classification file, which corresponds to or rather is a copy of the terminology, now includes not only the numbers of the case histories under the various diagnoses, but the interval results for these same diagnoses. In this way, for example, one can in a few minutes determine the one-year or three-year results in common-duct stone cases by turning to the file under "Cholelithiasis, Stone in the Common Duct."

4. It is essential to have a thoroughly organized and active follow-up system. Without a systematic and energetic follow-up of all cases there is always a tendency to report only the good results, for the failures go elsewhere for subsequent treatment. It is a noticeable fact that in hospitals having a thoroughly organized and efficient follow-up system, the percentage of poor results and of recurrences is much higher than in hospitals where reported results are based upon the "impressions" of the Attending or House staff. Impressions are not facts. Facts regarding the subsequent course of cholecystostomies, for example, as compared to cholecystectomies, cannot be obtained unless these two types of cases are followed up at regular intervals and are asked definite questions and examined from the anatomic, symptomatic and economic standpoints. If the patients are seen at three- to six-month intervals they are not lost track of so easily, their interest in the follow-up is kept active and their coöperation is far greater than if sporadic efforts are made at long intervals to get in touch with them. In a metropolis like New York, few of the patients of the type we see on the ward services live at one address longer than six months.

5. The natural result of a follow-up system is the result file, in which are recorded, under the same diagnoses as in the disease classification file, the results of the surgical treatment, at various intervals after operation. These

results are to be based upon the combined anatomical, symptomatic and economic condition of the patient at the time of each follow-up visit. The results from these standpoints should be recorded in an ascending scale of excellence. Failure is represented by 0, and 1 up to 4 represents degree of success. Thus a 000 would represent a failure anatomically, symptomatically and economically in a case of cholecystostomy where hernia after operation, with persistent symptoms of discomfort and indigestion, had resulted in the patient's inability to do any of his former work. A 444, on the other hand, would represent complete success in a case where the scar was linear and firm; where all symptoms of the disease had been relieved, and where the patient was working at his maximum efficiency. The results should be recorded in the file for the intervals under observation, and should be reported as 3-, 6-, 12-, 24-, or 36-month results, according to the interval, rather than "end results." This principle is of special importance in recording results in neoplasms. Such a system is of particular value in comparing the relative advantages of several surgical procedures for the same lesion over various periods, as for example the efficacy of cholecystectomy compared to cholecystostomy in pancreatic lymphangitis, or in calculi in the gall-bladder or the relative advantages of the transverse and vertical incisions in gall-bladder operations.

6. The follow-up notes and results should be recorded by the surgeon intensively studying that particular group of cases that have been recorded in the history analysis; that is, he should follow the cases of that group whether he operated on them or not. Only in this way will the notes and the results be uniformly recorded. The details of the record room system at the Presbyterian Hospital, including descriptions of and photographic reproductions of the various parts of the disease classification file, the unit history, the follow-up system and interval result file are to be found in the Annual Surgical Report of the hospital which is to appear in printed form in November, 1918.

With these desiderata an accurate and comprehensive analysis of any group of surgical diseases can be had at the end of two to five years. With the data obtained from such an analysis, definite conclusions can be drawn as to diagnosis, treatment and prognosis and the true value of such a study will then be realized. Groups of cases, or systems thus intensively studied, give data not only for the individual surgeon to make use of in formulating his own ideas and reaching conclusions based upon fact, but provide cumulative material of increasing value as time goes on and as the facts are collected. A record system, as at present in active operation at the Presbyterian Hospital, increases its value from year to year, because material is accumulated, in available form, for subsequent analysis and there does not occur the deplorable waste of clinical experience so common in so many large hospitals. As an example of this benefit, I would mention the use to which the record system is being put by the Surgical Pathology Laboratory in collecting interval results for all the tumor and tuberculosis specimens that come to the



## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

laboratory. The education of the medical students, to say nothing of the surgical staff of the hospital in this systematic, comparative study of the tumors coming to the hospital, is in itself worth all the effort and expense of maintaining such a record system.

Constructive work in a hospital, as a result of prolonged and persistent effort, is frequently not appreciated until others, making use of the material available because of such constructive work, attract the attention of the profession and even of the laity to the value of an individual's accomplishment. For ten years, Dr. Adrian Lambert, now Surgical Director of the Presbyterian Hospital, has been developing, and encouraging his colleagues to develop, an accurate, comprehensive and educational hospital record system. In the first few years there had to be overcome that inertia of hospital and staff tradition that has brought to a dead stop so many needed reforms. As the advantages and improvements of the system became apparent, other members of the attending staff were encouraged to develop new phases, such as the follow-up system, the unit history and the result file. To Doctor Lambert belongs the credit for developing the present complete and growing record system at the Presbyterian Hospital.

During the past two years, with the above-mentioned features available and actively coöperating in the record system of the Presbyterian Hospital, a history analysis of the surgical diseases of the biliary tract has been undertaken and is continuing. It is interesting to note that in the cases where the analysis chart was filled in at the time the patient was in the hospital 94 per cent. of the desired data was secured, whereas in the cases where the chart was filled out after the patient had left, from information available in the old history, and where the case was recorded without reference to the chart, only 22 per cent. of the desired data was found.

The analysis chart for surgical diseases of the biliary tract, as now in use in the study of some 400 cases, is presented herewith.

## HISTORY ANALYSIS FOR SURGICAL DISEASES OF THE BILIARY TRACT.

Case No.                  History No.                  Patient's Name:  
Sex:              Age:              Admission date:              Address:  
                         Discharge date:  
Operator: .....

## I. CHIEF COMPLAINT:

1. Pain in 1) Epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) Rt. shoulder 6) in back between shoulders 7) All over abdomen 8) at navel.
2. Soreness in 1, 2, 3, 4, 5, 6, 7, 8.
3. Vomiting.
4. Jaundice.
5. Clay colored stools.
6. Pruritus.
7. Biliary Fistula.
8. Symptoms of Indigestion:
  1. Feeling of Distress in 1) Epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) Around navel.

ALLEN O. WHIPPLE

2. Feeling of Distention in 1, 2, 3, 4, 5.
3. Feeling of a Lump in 1, 2, 3, 4, 5.
4. Belching of gas 5. Sour eructations.
9. Constitutional Disturbances:
  1. Fever. 2. Chills. 3. Loss of Weight. 4. Loss of Strength. 5. Loss of Appetite. 6. Malaise. 7. Constipation. 8. Diarrhœa.

II. HISTORY OF PRESENT DISORDER:

1. History of Present or Last Attack:

1. Onset:

1. Mode: 1) Sudden 2) Gradual.
2. Time of Onset: 1) Day 2) Night.  
..... 1) hrs. 2) days 3) weeks 4) months ago.
3. Duration of Attack: ..... 1) hrs. 2) days 3) weeks 4) months.

2. Pain:

1. Type: 1) Constant 2) Intermittent.
2. Character: 1) Sharp 2) Dull 3) Colicky 4) Cramp-like 5) Stabbing or knife-like 6) Burning 7) Gnawing 8) Boring 9) Aching.
3. Location: 1) Epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) About Navel 6) Rt. Shoulder 7) In back between shoulders.
4. Localized to 1, 2, 3, 4, 5, 6, 7.
5. Radiation to 1, 2, 3, 4, 5, 6, 7.
6. Relation of onset of attack to meals. .... hrs. after ingestion of food.

- |                   |   |
|-------------------|---|
| 7. Eased by:      | { 1) Vomiting 2) Defecation 3) Urination 4) Sitting up. Lying down on 5) back 6) rt. side 7) left side 8) pressure over epigastrium 9) over R.U.Q. Medication by 10) mouth 11) hypodermic 12) hot application 13) cold application 14) belching gas. Food 15) meats 16) starches 17) fats 18) acids 19) fried or greasy food. |
| 8. Made worse by: |   |

3. Soreness or Tenderness.

1. Onset: ..... 1) hrs. 2) days 3) weeks ago.
2. Duration: ..... 1) hrs. 2) days 3) weeks.
3. Location: 1) Epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) around navel 6) Rt. shoulder 7) back.
4. Worse on deep inspiration.

4. Deranged Function.

1. Vomiting. 2. Nausea.

1. Onset: 1) with pain 2) ..... hrs. after pain 3) ..... hrs. after ingestion of food 4) before onset of pain.

2. Number of times.

3. Vomitus:

1. Color: 1) green 2) black 3) red 4) coffee-ground material.
2. Amount: 1) slight 2) moderate 3) large.
3. Food: 1) none 2) of last meal 3) of previous meals 4) mucus.
4. Taste: 1) acid 2) bitter.

4. Jaundice:

1. Onset: ..... days after onset of acute symptoms.
2. Duration: ..... 1) days 2) weeks 3) months.
3. Pruritus:
  1. Onset: ..... days after onset of jaundice.
  2. Duration: ..... days.

## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

4. Defecation:  
Movements have been 1) constipated 2) loose 3) normal 4) large 5) small 6) clay-colored 7) brown 8) black 9) contained gall stones 10) mucus 11) blood.
5. Symptoms of Indigestion:
  1. Feeling of Discomfort after meals in 1) epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) about navel.
  2. Feeling of Distention after meals in 1, 2, 3, 4, 5.
  3. Feeling of a Lump after meals in 1, 2, 3, 4, 5.
  4. Belching of Gas after meals. 5) Sour Eructations.
5. Constitutional Disturbances:
  1. Loss of Weight:.....lbs.  
In.....1) days 2) weeks 3) months 4) years.
  2. Loss of Strength (If possible express in per cent. of former strength.)
  3. Loss of Appetite.
  4. Chills, No.                      Daily.                      5. Has goose flesh been noticed?
  6. Fever for....days, weeks.                      7. Malaise.
2. History of Previous Attacks:
  1. Number of previous similar attacks.....Give the dates of the previous attacks accurately if possible.
  2. Number of dissimilar attacks.....State in what symptoms these attacks differed from the present or last attack:  
In.....attack there was:  
In.....attack there was:  
In.....attack there was:
  3. Operation was performed.....months ago. Name operation:
  4. Symptoms of Indigestion have been present for.....1) weeks 2) months 3) years.
    1. Feeling of Distress after meals in 1) epigastrium 2) R.U.Q. 3) L.U.Q. 4) R.L.Q. 5) about navel.
    2. Feeling of Distention after meals in 1, 2, 3, 4, 5.
    3. Feeling of Lump after meals in 1, 2, 3, 4, 5.
    4. Belching of Gas after meals. 5. Sour Eructations after meals.
  5. Symptoms of Present Disorder began during or soon after the.....pregnancy.  
Symptoms of the.....attack began during or soon after the.....pregnancy.  
Symptoms of the.....attack began during or soon after the.....pregnancy.  
Did symptoms of present disorder begin 1) before the menopause 2) after the menopause?  
Do symptoms of present disorder have any relation to menses?  
Do attacks come on before, during, or after the period?
- III. HISTORY OF OTHER DISORDERS AND DISEASES:  
Name the diseases with the age of the patient at the time the disease was contracted and the duration of the disease if they were of the chronic type. This should include the venereal diseases. Be especially careful to ask for a history of typhoid fever and any previous peritoneal infection, such as appendicitis
- IV. FACTS RELATING TO THE PATIENT'S NORMAL AND ABNORMAL HABITS, CUSTOMS AND ECONOMIC CONDITION AND ROUTINE:
  1. Habits of.
    1. Eating: 1) regular 2) irregular 3) hearty 4) light 5) rapid 6) slow.
    - Diet: Patient eats 1) coarse cereals 2) fruit 3) green vegetables 4) fried foods.

## ALLEN O. WHIPPLE

Meat is eaten.....a day. Eggs are eaten.....a day. Bread 1)white  
2)whole wheat 3)graham 4)rye 5)bran. Fish is eaten.....a week.  
Cream.....a day. Butter.....a day.

Water is drunk.....glasses daily; coffee.....cups daily; tea.....cups  
daily.

2. Defecation:.....daily. Bowels move regularly 1)with catharsis 2)with-  
out catharsis.

Bowels move irregularly 1)with catharsis 2)without catharsis.

Movements are 1)constipated 2)loose.

3. Micturition.....during the night.

4. Sleep: 1)sound sleeper 2)light sleeper.

5. Exercise: 1)taken regularly 2)irregularly 3)none.

6. Work: 1)indoors 2)outdoors 3>manual 4)clerical 5)by day 6)by night  
7)average working hours.....

7. Drugs:

1. Alcohol in the form of 1)beer 2)ale 3)wine 4)whiskey or distilled  
liquors.

2. Number of drinks daily..... 3. Number of drinks before break-  
fast.....

Number of years that the patient has been taking alcohol.

2. Tobacco is used in the form of 1)cigars 2)cigarettes 3)pipe 4)chewing  
tobacco.

1. Number of smokes daily, average..... 2. Number of years that  
tobacco has been used....

3. Narcotic drugs are used in form of 1)Morphine 2)Opium 3)Cocaine  
4)Heroine.

2. Economic Condition: Monthly Income.....

3. Sexual History (for the female patients).

Menstrual History: 1)regular 2)irregular 3)painless 4)painful.

Marital History: 1)Number of Children..... State their ages for rela-  
tion to present disorder 2)Number of miscarriages. State  
time of occurrence.

4. Family History of gall-bladder disease in 1)mother 2)sisters 3)father  
4)brothers.

5. Intelligence of the patient is 1)excellent 2)fair 3)poor.

6. Accuracy of the history is 1)accurate 2)fair 3)inaccurate.

## V. EXAMINATIONS:

### 1. Physical Examination:

1. General: Admission T. .... P. .... R. ....

1)acutely ill 2)chronically ill 3)well nourished 4)poorly nourished 5)obese  
6)thin 7)emaciated 8)cachectic 9)nervous 10)apathetic 11)skin jaundiced  
12)sclerae jaundiced 13)pale 14)cyanotic 15)dyspnoeic 16)intelligent 17)  
unintelligent.

2. Head and Extremities:

Tongue: 1)moist 2)dry 3)coated. Tonsils 1)enlarged 2)inflamed.

Teeth: 1)in good condition 2)carious 3)pyorrhoea present 4>false.

Pupils: 1)react normally 2)do not react normally.

Extremities: 1)knee jerks active 2)sluggish 3)absent.

Superficial Lymph Glands: 1)enlarged 2)not enlarged.

3. Chest:

1. Heart: 1)normal 2)enlarged 3)compensated 4)not compensated. Blood  
Pressure, systolic:

2. Lungs: Normal.



## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

1. Signs of infiltration in 1) R.U.L. 2) R.M.L. 3) R.L.L. 4) L.U.L. 5) L.L.L.
2. Signs of consolidation in 1, 2, 3, 4, 5.
3. Signs of fluid in 1. Rt. chest. 2. Left chest.
2. Pelvic Examination:
  - Adnexa: 1) normal 2) inflamed.
  - Uterus: 1) normal 2) displaced 3) fibromyoma 4) carcinoma present.
  - Rectal: 1) normal 2) stricture or obstruction present 3) prostate enlarged 4) prostate inflamed.
3. Abdominal Examination:
  - Inspection: 1) contour 2) obese 3) scaphoid 4) distended 5) biliary fistula 6) operations in.....quadrant, epigastrium, hypogastrium 7) hernia present in R.U.Q. R.L.Q. epigastrium, hypogastrium inguinal region, umbilical region.
  - Palpation: Tenderness present in 1) R.U.Q. 2) over gall-bladder 3) epigastrium hypogastrium 4) R.L.Q. 5) at navel 6) L.U.Q. 7) general 8) rt. costovertebral angle 9) over rt. scapula 10) over border of trapezius, rt. left.
  - Rigidity present in 1, 2, 3, 4, 5, 6, 7.
  - Gall-bladder 1) palpable 2) movable from side to side.
  - Mass made out in 1, 2, 3, 4, 5, 6.
  - Liver edge palpable. ....cm. below costal margin. Spleen palpable. Rt. kidney palpable.
4. Radiographic Examination:
  - Gall-stone shadow 1) present 2) not made out.
  - Stomach: 1) normal 2) defect at pylorus 3) defect in duodenum 4) adhesions present.
  - Colon: 1) normal Obstruction noted at 2) cecum 3) hepatic 4) splenic 5) sigmoid 6) rectum.
5. Clinical Pathology.
  - Blood Examination: W.B.C..... Poly.....% R.B.C.....Hgb.....%.
  - Blood Culture 1) sterile 2) positive for.....
  - Blood Cholesterin reading..... Blood Coagulation Time.....
  - Gastric Analysis: 1) free HCl present 2) absent 3) lactic acid present 4) Boas-Oppler.
  - Sputum Examination: Pneumococcus Group I, II, III, IV. T.b.c. present.
  - Feces positive for 1) occult blood 2) bile 3) pancreatic ferments normal, diminished 4) ova, parasites 5) gall-stones 6) total fats.....
  - Urinalysis: 1) albumen 2) casts 3) pus 4) sugar 5) R.B.C. 6) bile 7) cystoscopy neg. 8) acetone 9) diacetic acid.
  - Wassermann Reaction: 1) positive 2) negative. Widal Reaction 1) positive 2) negative
  - Cambridge Test: 1) positive 2) negative.

## VI. DIAGNOSIS BEFORE OPERATION: 1) based upon History 2) upon Examinations.

- 1) Cholelithiasis 2) gall-stones in gall-bladder 3) in cystic duct 4) in common duct 5) Chr. cholecystitis 6) Chr. pancreatitis 7) Cholangitis 8) Chr. appendicitis 9) Acute appendicitis 10) Acute cholecystitis 11) Gangrenous cholecystitis 12) Ac. pancreatitis 13) Gastric ulcer 14) Duodenal ulcer 15) Perforated ulcer 16) Diffuse peritonitis 17) Acute ileus 18) Carcinoma of pancreas 19) Carcinoma of stomach 20) Biliary fistula 21) Mucus fistula.

## ALLEN O. WHIPPLE

### VII. OPERATION:

#### 1. Findings:

Gall-bladder: 1) Acutely inflamed 2) gangrenous 3) chronically inflamed 4) distended 5) collapsible 6) contracted 7) adhesions about gall-bladder 8) tumor in G.B. 9) adherent to common duct 10) not collapsible 11) normal 12) perforated 13) congenitally absent.

Gall-stones found in 1) gall-bladder 2) cystic duct 3) common duct 4) at papilla of Vater 5) rt. hepatic duct 6) left hepatic duct.

Cystic duct: 1) patent 2) thickened 3) dilated 4) adherent to gall-bladder 5) to common duct 6) closed.

Common duct: 1) patent 2) thickened 3) dilated 4) cystic 5) strictured 6) hepatic duct dilated 7) closed.

Bile was 1) normal 2) thickened or inspissated 3) mucoid 4) purulent 5) granular.

Pancreas was 1) normal 2) enlarged 3) hard 4) acutely inflamed 5) chr. inflamed 6) nodular.

Liver was 1) normal 2) enlarged 3) cirrhotic 4) contained abscesses 5) perihepatitis 6) left lobe missing.

Lymph Nodes were enlarged in 1) gastrohepatic omentum 2) about cystic duct 3) common duct.

Tumor Mass was made out in 1) gall-bladder 2) pancreas 3) pylorus 4) liver 5) colon 6) stomach.

Biliary fistula was found between skin and 1) gall-bladder 2) common duct 3) hepatic duct.

Normal: 1) gall-bladder 2) pancreas 3) stomach 4) duodenum 5) appendix 6) liver 7) colon 8) no pathological lesion found 9) rt. kidney.

Ulcer found at 1) pylorus 2) duodenum 3) adhesions present about pylorus.

Appendix was 1) normal 2) acutely inflamed 3) chr. inflamed 4) cystic 5) tuberculous 6) carcinomatous.

2. Procedure: 1) cholecystectomy 2) cholecystostomy 3) cholecystotomy 4) choledochotomy 5) choledochostomy 6) cholecystenterostomy 7) exploratory celiotomy 8) appendicectomy 9) gastroenterostomy 10) cholecyst gastrostomy 11) plastic repair of biliary ducts 12) transduodenal choledochotomy 13) common duct explored 14) ampulla of Vater dilated 15) gall-bladder sutured to parietal peritoneum.

Incision made was 1) vertical rt. rectus 2) hockey stick 3) transverse 4) mid line vertical.

Drainage used was 1) rubber tube 2) catheter 3) cigarette 4) gauze 5) rubber tissue, into the 1) gall-bladder 2) common duct 3) hepatic duct 4) Morrison's pouch 5) to the pancreas.

Cystic duct was 1) clamped and tied with cystic vessels 2) tied separately 3) cauterized.

Anæsthesia used was 1) gas ether Bennett 2) drop ether 3) gas oxygen 4) gas oxygen ether 5) chloroform 6) local Novocaine 7) local Cocaine.

### VIII. DIAGNOSIS AT OPERATION:

1) Cholelithiasis 2) gall-stones in gall-bladder 3) in cystic duct 4) in common duct 5) chronic cholecystitis 6) chr. pancreatitis 7) cholangitis 8) chr. appendicitis 9) acute appendicitis 10) acute cholecystitis 11) gangrenous cholecystitis 12) acute pancreatitis 13) gastric ulcer 14) duodenal ulcer 15) perforated ulcer 16) diffuse peritonitis 17) acute ileus carcinoma of 18) gall-bladder 19) pancreas 20) stomach 21) biliary fistula.

## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

### IX. PATHOLOGICAL REPORT No. ....:

Gross specimen consisted of 1) gall-bladder 2) gall-stones 3) bile 4) lymph glands; tissue from 5) gall-bladder 6) stomach 7) pancreas 8) liver 9) peritoneum 10) fistula 11) appendix.

Gall-bladder: Color 1) normal 2) green 3) red 4) black 5) mottled.

Measurements were.....cm.

Walls were 1) normal 2) moderately thickened 3) measured ..... 4) very thick.

Contained 1) bile 2) gall-stones 3) mucus 4) granular material 5) pus.

Adhesions around gall-bladder were 1) fibrinous 2) fibrino-purulent 3) old.

Mucosa was 4) hypertrophied 5) atrophic 6) absent 7) necrotic.

Gall-stones (state number).....1) single large cholesterol stone 2) faceted 3) mulberry 4) polygonal 5) combination stone present.

Composition: 1) pure cholesterol 2) cholesterol-calcium-bilirubin 3) bile pigment.

Culture of gall-stone showed..... Analysis showed 1) bile salts 2) cholesterol 3) calcium.

Culture of bile showed.....

Diagnosis: 1) cholelithiasis 2) chr. cholecystitis 3) acute cholecystitis 4) chr. pancreatitis 5) acute appendicitis 6) chr. appendicitis 7) Ca. of G.B. 8) Ca. of stomach 9) of lymph gland 10) gastric ulcer 11) duodenal ulcer 12) Ca. of pancreas 13) biliary fistula 14) fat necrosis.

### X. HISTORY OF POSTOPERATIVE COURSE AND CONDITION:

#### I. Postoperative Course.

1. First 24 hours: 1) nausea 2) vomiting 3) headache 4) shock 5) hemorrhage.

2. Pulmonary: 1) pneumonia 2) pleurisy 3) bronchitis 4) empyema 5) abscess lung 6) oedema of lungs.

3. Cardiovascular: 1) fibrillation 2) cardiac decompensation.

3) Thrombosis of 1) femoral, rt. lt. 2) internal saphenous 3) external saphenous 4) mesenteric.

4) Embolism: 1) pulmonary 2) cerebral.

4. Alimentary.

1) Distention 2) acute ileus 3) acute dilatation 4) colitis 5) acute cholangitis

6) Bile appeared in faeces on.....day.

5. Renal:

1) Acute suppression 2) acute retention 3) uremia 4) cystitis 5) pyelitis 6) pyelonephritis 7) acute nephritis 8) chronic nephritis.

6. Infection of 1) operative wound 2) abdominal wall 3) peritonitis 4) residual abscess of..... 5) subphrenic abscess.

7. Dressing: 1) Sutures removed on.....day 2) drains removed from gall-bladder 3) drain removed from common duct .....day 4) drain removed from Morrison's pouch.....day 5) drain removed from abdominal wall 6) wound closed.....day 7) bile stopped flowing from wound.....day 8) biliary fistula closed.....day.

8. Patient discharged on.....day after operation.

9. Result on discharge 1) improved 2) unimproved 3) died on.....day.

2. Advice and instructions as per pamphlet 1) were given 2) were not given.

3. Follow-up notes (the date of examination or report to be recorded in Chronological Table with the numbers as indicating condition at time of report).

1) Chief complaint cured 2) symptoms of indigestion cured 3) strength.....% 4) working capacity.....% 5) earning capacity.....% 6) weight.....lbs.

Date of partially resuming work. Date of resuming full work.

ALLEN O. WHIPPLE

- 7) Appetite: 1) good 2) fair 3) poor.  
8) Bowels: 1) regular with artificial measures 2) without artificial measures 3) irregular with artificial measures 4) without artificial measures 5) advice given in Ward before leaving the Hospital was followed 6) advice given in Ward before leaving the Hospital was not followed 7) constipated 8) loose.  
9) Examination.  
1) Scar firm, no hernia 2) sinus present 3) bile discharging 4) no abdominal tenderness 5) no masses made out 6) masses felt in..... 7) jaundice present 8) hernia present in scar.

XI. FINAL RESULT:.....months after operation 1)cured 2)improved 3)unimproved.

XII. AUTOPSY FINDINGS: Details to be filed under each case if patient comes to autopsy.

The master sheet is a copy of this chart, but so arranged that each fact to be recorded corresponds to a square of quadrilled paper, or if there are subdivisions to such a heading these are numbered and the number or numbers can be recorded in the appropriate square under the case that is being analyzed and recorded on the unit sheets. The information from the history analyses is tabulated on the large unit sheets and the information thus tabulated can be summarized in the left-hand margin of the unit sheets. The totals recorded in this way give the figures for each item in the series studied; thus it is possible at a glance to find the number of cholecystectomies performed in the series, or the number of cases in which a single cholesterol stone was found.

By means of cross reference, *i.e.*, by noting the numbers of the case histories showing a particular feature, other desired data on that group can be obtained by referring to the appropriate squares in the master sheets under those history numbers. Thus one can readily find the late or the interval results in operated cases associated with lesions in the pancreas, or in cases showing single gall-stones, by analyzing the follow-up data. Once the information (the desired data) is recorded, the cross-reference possibilities come down largely to a matter of permutations and combinations.

But it cannot be emphasized too strongly that the value and the validity of such determinations is dependent upon the accurate and honest recording of the facts while these facts are available from the patient or those having to do with his treatment. Thus a series of one hundred accurately recorded cases is of more scientific value than a thousand where incomplete data were obtained from the average hospital history.

From a study of the carefully analyzed cases in the Presbyterian Hospital series the following are some of the observations that stand out prominently:

1. Aside from the typical character and radiation of the pain in biliary colic the most constant symptoms of gall-bladder disease are those of "indigestion," *i.e.*, a feeling of epigastric distress, or a distended or "bloated" feeling in the epigastrium or left upper quadrant and the belching of gas. This group of symptoms occurred in 78 per cent. of the cases.



## ANALYSIS—SURGICAL DISEASES OF BILIARY TRACT

2. These symptoms are of much longer duration than is usually appreciated, especially in women. This places the onset of the cholecystitis or cholelithiasis in an earlier decade than is usually given; certainly in women the disease usually begins in the third or the fourth decade, during the active child-bearing period.

3. Cholelithiasis was present five times more frequently in women than in men in this series. Eighty per cent. of these women gave a history of one or more pregnancies. Thirty-two per cent. of the parous women gave the history that their first attacks of biliary colic occurred during the later months of pregnancy. The fact that many women gave the history of onset of symptoms during the menopause taken in conjunction with the facts relating to pregnancy emphasizes the importance of a hypercholesteremia as a causative factor in gall-stone disease.

4. Jaundice was not a prominent symptom or physical sign in this series—only 35 per cent. giving the history of jaundice and only 20 per cent. showing jaundice in skin or sclerae at the time of examination.

5. Involvement of the pancreas, as observed at the time of operation in the form of an enlarged, indurated organ, or the so-called pancreatic lymphangitis of Arnsperger, a localized induration of the head of the pancreas about the common duct, was present in 36 per cent. of the cases. This was found not only in the common duct stone cases, but in many cases in which the gall-bladder did not appear markedly diseased, but where the lymph-glands draining the gall-bladder and ducts were enlarged and in many cases having the so-called "strawberry" gall-bladder with or without stones. Such cases gave much better results with cholecystectomy and choledochostomy than those treated by cholecystostomy. In the latter subjective symptoms of fat and proteid indigestion recurred or persisted much more frequently.

In cases of chronic pancreatitis prolonged drainage of the common duct with cholecystectomy gave better results both from the standpoint of immediate operative risk and subsequent relief of symptoms than in the cases where attempts were made to dilate the strictured duct or maintain a passage into the duodenum by means of catheter drain.

6. A hepatitis, either in the form of a localized or contiguous inflammation about the gall-bladder and ducts, or a general involvement, a true biliary cirrhosis was found on gross examination of the liver in 21 per cent. of the cases of cholecystitis. The lesion was found present on microscopical examination in all cases from which a section of the liver was removed. This corroborates the observations of Evarts A. Graham, of Chicago.<sup>1</sup> In two cases, the liver was enlarged, sections showed a marked cirrhosis, both biliary and portal, in one case ascites was present, and in both cases followed carefully after operation the liver decreased in size and the symptoms of

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<sup>1</sup>Evarts A. Graham: Hepatitis; a Constant Accompaniment of Cholecystitis. *Surgery, Gynecology and Obstetrics*, vol. xxvi, p. 521.

cirrhosis disappeared following cholecystectomy and choledochostomy. In both these cases there was a marked associated pancreatic lymphangitis causing common duct obstructions.

7. Postoperative pneumonitis proved to be the most frequent major complication.

8. In the common duct obstruction cases hemorrhage during and following the operation proved the most serious complication. Jaundice was not necessarily present, for in two cases of long-standing biliary fistula the patients died of uncontrollable oozing from the wound.

The one measure, used both as a preoperative and postoperative form of treatment in these cases, that proved to be unquestionably effective and, in several cases, life saving, was the intravenous infusion of a 0.2 per cent. calcium lactate in normal salt solution. This was given in a 200-500 cc. quantity. By coagulation time tests it lowered the clotting time by one-third to one-half in the eight cases in which it was tried. In the deeply jaundiced patients, where it was used four to six hours before operation, no persistent bleeding occurred; in the cases where it was given after oozing from the wound had become pronounced, the bleeding was invariably stopped. As a means of treating hemorrhage it proved very much more efficacious than the administration of bile, serum treatment or blood transfusion.

9. The comparison of the results following operations for gall-stone disease with those for gastric and duodenal ulcer and so-called chronic appendicitis is very much in favor of gall-bladder surgery. That is, comparing the interval results, 4 4 4, *i.e.*, a scar without hernia, entire relief of symptoms and a return of the patient to economic efficiency, in these diseases since the interval result system has been in operation at the Presbyterian Hospital, a period of two years, one finds "4 4 4" in 73 per cent. of gall-stone disease, in 54 per cent. in gastric ulcer, in 72 per cent. in duodenal ulcer, and in 54 per cent. in so-called chronic appendicitis.

## A CONTRIBUTION TO THE STUDY OF MYOSITIS OSSIFICANS PROGRESSIVA

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WITH the first case of myositis ossificans progressiva described in medical literature over two hundred and twenty years ago, and for sixty years the course and pathology of this strange and rare malady well studied, its character and etiology are still unsettled and the subject of vivid controversy.

The fact that another resemblant disease, the myositis ossificans circumscripta, produces identical pathological anatomical tissue changes in isolated muscles has not helped to clear up the mystery of its etiology and certain features in the symptom picture. The myositis ossificans progressiva is characterized by such a sharply outlined group of symptoms that it is marked as distinctly etiologically separate from its near namesake and not sharing anything with it in common save a relationship in local products of the pathological process.

These characteristic features are:

1. The ossification of muscles without any apparent cause, traumatic or otherwise.
2. The manifestation of the disease as a congenital one or appearing early in life.
3. The progressive course of the malady unaffected by therapeutical efforts, embracing in some of the most advanced cases nearly the entire voluntary muscular system.
4. The association with symptoms of defective anatomical and physiological formation, mostly of fingers and toes but not infrequently also of stature, habitus and sex differentiation.

These are the earmarks of typical cases of myositis ossificans progressiva, and, strange to say, there are very few exceptions, if any, of genuine cases of this malady which do not show them.

It is true that since Helferich first drew attention to the presence of microdactylia in patients suffering from progressive ossifying myositis, quite a number of histories have been published that do not mention this symptom in cases undoubtedly belonging to this malady, but I have ascertained through personal correspondence with the authors of a number of such publications that the reason for this has been a lack of attention in examining for this symptom, mostly due to an oversight in the outdoor department and also in a few hospital cases.

There are, however, a few cases where the authors have especially mentioned the absence of microdactylia, or similar anatomical defects, and these

are the observations which deserve special attention. Under the heading "remarks" of the collected case histories, the reader will remember this difference between *microdactylia not mentioned* and *microdactylia noted as absent*. The later definite statement should, in future, accompany all histories of such cases verified by the X-ray pictures of the hands and feet.

I have taken the trouble in compiling in chronological sequence all the accessible cases of myositis ossificans progressiva. It seemed to me to be an effort well worth while to assemble in brief all the known data of this rare and mysterious disease, as my studies of its literature disclosed many errors and omissions in the two or three fractional prior attempts.

The reason for undertaking this work was my own observation of a most interesting typical case, presenting among its symptoms the unique feature of several isolated and independent foci of ossification in the skin, a tissue hitherto believed to be exempt from this pathological change. It afforded unprecedented opportunity to observe and study the entire course of ossification from its first beginning to the completed bone-formation, a study which led me to advocate a change of view as to the primary factor of ossification in this disease.

In the arrangement of this paper I shall first give abstracts of all cases of myositis ossificans progressiva published to date, then present my own case and finally discuss the views of the pathology and etiology in the light of knowledge obtained by the study of the existing literature and of the findings of my patient.

#### ABSTRACTS OF CASES RECORDED IN LITERATURE

CASE I.—Reported by Guy Patin in 1692. Female. Subsequent course of disease unknown. Writes to A. F. (?) referring to a previous letter sent him, wherein he also mentioned the case of a woman who finally became as hard as wood all over.

CASE II.—Reported by John Freke, in 1743. Male, aged 14 years. First symptoms appeared at 11 years of age—swellings on back, muscles and vertebræ of back. Began with swellings three years ago, then growths spread over entire back from cervical vertebræ to os sacrum, and arising also from every rib, forming coral-like ramifications. Third year, from nape of neck to os sacrum and the lateral muscles of back; ossifications like coral branches, especially on back. No congenital abnormalities mentioned.

CASE III.—Reported by Rev. Dean Copping and Robert, R. R., Lord Bishop of Corke, and Charles Smith, in 1744. Skeleton of man, aged 60 years. First symptoms appeared at (?) 18 years of age. Subsequent course of disease unknown. Entire skeleton one mass. Could not open jaws, fed through gap in teeth. Vertebræ consolidated by lateral outgrowths with scapula. One bone, very thin, about four inches long, found in fleshy part of arm, *quite distinct and disengaged from any other bone in his body*. Ridges and reefs of bone through fleshy parts of both thighs like shoots of coral, eight to nine inches long. From back of calcaneum grow spurs of bone. No congenital abnormalities mentioned.

CASE IV.—Reported by William Henry, in 1759. Male, aged 19 years. First symptoms appeared at 17 years of age—right arm, swellings and pains in wrist. Both arms, ankles, and legs up to knees attacked. Both arms from elbows to wrists just like a solid mass of bone; later pain, swellings and ossifications attacked ankles, creeping up fleshy part of calves to knees. Was treated with mercurials to salivation. (Observation covering two years.)



## MYOSITIS OSSIFICANS PROGRESSIVA

CASE V.—Reported by Abernethy, in 1830. Male, aged 14 years. First symptoms and age at their appearance unknown. Various bony masses had formed at different times and disappeared again. Back greatly deformed by irregular hillocks of earthy matter over *processi spinosi*. Head immovably fixed backward and to one side. Exostosis on both *ossa brachii*, and tendinous margins of *axillæ* ossified so that arms were pinioned closely to his sides. Exostosis on pelvis between *os sacrum* and *coccyx*. No congenital abnormalities mentioned. Abernethy found urine contained less lime than normal. Two years later he gave patient phosphoric acid, 4.0 per diem in divided doses, with the result that normal quantities of phosphates of lime were excreted in the urine. When phosph. acid was discontinued deficiency of lime occurred again.

CASE VI.—Reported by David L. Rogers, in 1833. Male, aged 13 years. First symptoms appeared when at the age of 12 years and 6 months—stiffness in arms and neck. Very rapid course, attacking muscles of back and chest. Superior portion of *pectoralis major* and *sternocleido* from sternum to middle portion ossified. A number of osseous swellings in back. Scapula fixed to ribs, studded with bony excrescences; all muscles connected with scapula—viz., *trapezius*, *rhomboideus*, *subscapularis*—more or less ossified; *latissimus* and *longissimus dorsi* formed large bony plates from their origin to angle of scapula. No congenital abnormalities mentioned.

CASE VII.—Reported by Testelin, and Charles Dambesi, in 1839. Male, aged 26 years; mother suffered from rheumatism; patient fell on right thigh. First symptoms appeared at 18 years of age—pains and limping after trauma. Right thigh attacked. Five years later pains in all extremities, movements began to be difficult, particularly scapulo-humeral articulation. Continued to move around seven years longer till he was unable to move either jaws, arms or legs. Became completely unable to move limbs or jaws. Twenty-one years later died, 39 years old. Autopsy showed ossification of right temporal and portion of left pterygoid, left deltoid, both *pectorales major*, left minor right *coracobrachialis*. Both *biceps brachii*, left triceps, right *latissimus*, right long *dorsalis*, right *glutæus med.* and left *med.* and minor, and most of thigh muscles on both sides.

CASE VIII.—Reported by Caesar Hawkins, in 1844. Male, aged 22 years. First symptoms appeared at 22 years of age (June, 1843)—lumbar and dorsal regions attacked. Violently painful swellings in lumbar and dorsal regions, which disappeared, leaving in places some small bony masses. Disease later attacks neck and scapular regions. New attacks began in October, 1843, and persisted during the next six months of observation. (One year after symptoms of disease.) Lumbar *vertebræ* immovably bound together by osseous masses; unable to use shoulders freely, particularly on left side, owing to swelling under angle of scapula and ossification of tendon of *pectoralis major*. Small exostosis on rib on either side (which rib?). No congenital abnormalities mentioned.

CASE IX.—Reported by G. Wilkinson, in 1846. Female, aged 21 years. First symptoms appeared at 8 months of age—stiffness in arms and lumps on back. Could move about and work till 11 years old, then lost motion in elbow-joints; other ossifying processes progressed rapidly. Chest cavity much diminished by curvature of dorsal *vertebræ* and acute angularity of ribs. Numerous thin ossific plates in anterior and posterior chest muscles, as *pectorales*, first *dorsi* and *erectorides spinæ*, and one plate ten and a half inches long connected to crest of left ilium and short branches running from it into *rhomboidei* to base of left scapula into *infraspinatus*; similar band from right crest of ilium to various *vertebræ* up to transverse process of third dorsal. Other irregular plates of bone connected spinal processes of dorsal and lumbar *vertebræ* and ribs connecting with sacrum by short tendinous fibres. Numerous bands of osseous matter in depressions of lower jaw; portion of bone two and one-half inches long in left *biceps brachii*. Two irregular bony processes, one from lower end of left humerus three inches downward into *pronator teres* and *flexor muscles* of

## JULIUS ROSENSTIRN

forearm; other from outer edge posteriorly extending into triceps and extensor carpi rad. longior et brevior. No congenital abnormalities mentioned.

CASE X.—Reported by King Kelburne, in 1854. Female. First symptoms appeared at 3 weeks of age—defective power of suckling and swallowing. Nourishment had to be brought into posterior part of mouth with spoon. Author discovered tumor on right side of tongue, size of large bean, judged to be of vascular nature, and therefore injected a few drops of perchloride of iron. In spite of a supposed improvement following this measure the child did not mend and died about five months later from inanition. Subsequent course of disease unknown. The post-mortem showed ankylosis (bony) between inferior maxilla and temporal bones, musc. masseter replaced by a large osseous plate descending from the inferior margin of the zygomatic process and malar bone. The osseous deposit extended as far forward as the anterior process of the malar bone, incorporated itself in its downward passage with the tuberosity of the superior maxilla, and finally amalgamated with the angle base and ramus of the inferior maxilla. These changes were on both sides. Vascular tumor on tongue had nearly entirely disappeared, leaving a fibrinous remnant of about the size of a split pea. No account given of other parts.

CASE XI.—Reported by Jonathan Hutchinson, in 1860 and 1892. Male, aged 12 years. First symptoms congenital. Midwife noticed deformities; patient put in London Hospital on their account. Subsequent course of disease unknown. Left shoulder, wrist, and carpal joints ankylosed. Left humerus shorter than right and bony ridge running down outer side. Large plates of bony substance in fascia of forearm, palm and back of hand. On right side small areas of bony structure in fascia above and below elbow-joint. No congenital abnormalities mentioned. At the age of 37 years the ossifications have largely increased in size and extent, and over right scapula and in posterior fold of right axilla new bony plates have developed. Movement of thorax during respiration extremely limited.

CASE XII.—Reported by William Skinner, in 1861. Male, aged 13 years. Family history negative. First symptoms appeared at 7 years of age—arms, back and right shoulder attacked. Stiffenings in arms, swellings in nape of neck and behind right shoulder. Stiffness at first was so bad that arms could not be brought to mouth. This improved later so that he could with difficulty feed himself, but hard nodules formed on different parts of body, especially breast and vertebral column. If patient receives blow or knock a hard swelling follows, preceded by pain and slight fever. Patient somewhat bent forward; slight motion in left shoulder, none in right. Arms cannot be extended and lie half bent across abdomen. Spine and scapula immovable. Small bony protuberance on ribs. Right pectorales changed into bony mass—continued into biceps until insertion at radius. Hard nodules at various places. No congenital abnormalities mentioned.

CASE XIII.—Reported by Ivan Minklewitsch, in 1864. Female, aged 15 years. Family history negative. First symptoms appeared at 5 years of age—swelling and stiffness in lower part of neck. A few years later osseous tumors in back and upper extremities began to develop, then attacked lower extremities. Three years ago pain and swelling in right knee disappeared and a week later reappeared. Exostoses in left temporal region at insert of temporal muscle; similar ones over left temporal and over acromion. Muscles forming posterior wall of right axilla ossified. Pectorales show same change, also small rough exostoses over cond. int. humeri. Left arm a similar ossification of axillary muscles. Right lower extremities: over articular tibia tarsalis stalactite-formed exostosis, similar one over fibula; another below lower margin of patella; in soleus muscle osseous growth size of hen's egg; in fossa poplitea narrow one extending upward to thigh and in stalactite formation reaching nearly plica glutealis and inguinalis. Left lower extremities: similar growth below patella as on right side, extending upward and inward to fossa poplitea and ending at upper end of middle third of thigh; sharp-pointed exostoses on outer side of astragalus and

## MYOSITIS OSSIFICANS PROGRESSIVA

outer malleolus. No congenital abnormalities mentioned. Report of autopsy, in 1871: New ossifications had formed at the right upper extremity on the upper posterior third of humerus and over inner part of that bone near elbow. The exostoses over cervical vertebrae and over second to fourth ribs were considerably enlarged.

CASE XIV.—Reported by Johanne Zollinger, in 1867, and Theodor Billroth, in 1869. Male, aged 24 years. Believed to have been caused by fall (?). First symptoms appeared at 3 years of age—arms first showed stiffness in movements. Movements of arms grew more and more difficult, and after a few years present state developed. Bent forward in lumbar position of vertebral column. Head bent forward; mouth can only be slightly opened for introduction of little finger. Both sternocleidomuscles changed to rigid cords. Arms in slight abduction and flexion in elbow-joints; tendons of pectorales and deltoids hard and very tense. Back shows many protuberances of hard osseous consistency, situated mostly around the lower part of lumbar region; they branch off in many different directions. Especially large is a ridge going on either side into glutæus maximus; others in regions of sacrospinalis, irregular and asymmetrical. Both latiss. dorsi nearly entirely converted into bone. First interphalangeal joint of left middle finger thickened by exostoses, and small roundish exostosis on left index finger. Small exostosis at inner side of left tibia and on outer side of r. cond. ext. femur. No congenital abnormalities mentioned.

CASE XV.—Reported by Muenchmeyer, in 1868, and A. Jurasz, in 1873. Female, aged 22 years. Family history negative. Fall when 4 or 5 years of age. First symptoms appeared between 4 and 5 years of age—neck and right arm; nodules on nape of neck. Development of right-sided scoliosis; stiffness of neck and right arm. After first nodules on nape of neck had disappeared others came in different parts of body. Brain fever at 12 years of age. In May, 1864, had scarlatina. Patient does not recollect ever having been able to turn her head freely or move arms away from her sides. Asserts never to have been able to dress herself or to do up her hair. Cervical column and head completely immovable; position of head in right-sided caput obstipum. Dorsal spine right-sided scoliotic and immovable; both scapulae firmly fixed. Left arm nearly completely immovable in elbow-joint; a nodulous osseous mass between cond. ext. hum. and olecr.; left biceps brachii one solid mass and long bony stalactite extending from middle toward axilla. Hard ossified parts also in deltoid. Both latiss. dorsi and trapezii, teres major and minor are changed to osseous masses. Also the enormously thickened lig. nuchæ. No congenital abnormalities mentioned. Latest observation in 1869; all changes have remained, and in addition the whole back one solid mass, protuberances, nodules and ridges, with some softer parts intermixed. A six-centimeter broad osseous mass leading from vertebral column to scapula fixing the latter completely. On the supraclavicular fossa everything except the omohyoideus seems to be ossified. In right leg whole gluteal mass ossified; from thigh down to knee several broad bony masses. During time of observation various places all over the body showed swellings, which disappeared again. Immovability of jaws increased so that patient could take only liquid food. In 1869 disease got worse and continued from bad to worse. In 1872 m. gracilis involved. In November mental trouble began. February 26, 1873, she fell and broke her right arm. Plaster-of-Paris dressing, cured in two weeks. No excessive callus. Died in thirty-second year of her life. Mays' autopsy report in 1874.\* The autopsy report by Mays is too lengthy to be given here. It adds some exostoses to the ossifications found during lifetime, but shows the cerv. muscles not to have been ossified, only hard and infiltrated with a connective tissue hyperplasia. No examination of fingers or toes. The spinal cord and periph. nerves were examined by Doctor Schultze† and found normal.

\* Virchow's Arch. f. patholog. Anat. und Phys., bd. 74, p. 145.

† Erb and Schultze; ein Fall v. progress. Muskelatrophie, etc. Arch. f. Psychiatric und Nervkrkhtn, 1879, bd. 60, h. 2, pp. 385-6.

## JULIUS ROSENSTIRN

CASE XVI.—Reported by Breschet, in 1869. Skeleton. Subsequent course of disease unknown. In addition to real exostoses, also multiple and symmetrical ossifications of muscular attachments. Skeleton in Musée Dupuytren (Paris).

CASE XVII.—Reported by William Byers, in 1870. Male, aged 17 years. First symptoms appeared at 8 months of age—small tumors size of small marbles appearing in different parts of body. Various parts of body attacked. Stiffness of joints, hips and shoulder-joints. The first nodules disappeared, but after twelve to eighteen months stiffness of joints set in again. Gradual ankylosis followed, and at the age of 10 years left hip and shoulder joints were completely ankylosed. Later the muscular system began to show ossification. Chest became as though enclosed in a complete sheet of bone, leaving no trace of outline of ribs. Head was immovably fixed by ossification of both sternocleidæ. Up to his seventeenth year muscles of mastication remained unaffected. Could at first move slowly and cautiously over smooth surface; with ankylosis progressing this became impossible. No congenital abnormalities mentioned. Remained small; sexual infantilism. Died at the age of 21 years; muscular system almost completely ossified.

CASE XVIII.—Reported by Florschuetz, in 1873, and Gerber, in 1875. Male, aged 12 years. Family history negative. First symptoms appeared at 5 years of age—hard inflamed nodules in right latiss. dorsi below right scapula. Latiss. of left side, upper extremities and back attacked later. After having attacked shoulders and upper extremities it progressed to muscles of back, trunk, neck and mastication (tempor. and masseter) and upper parts of lower extremities. Frequent nocturnal epileptic attacks. Absolute stiffness of large muscular groups. The greater part of muscles of neck, all muscles of mastication, causing complete lockjaw (nutrition through gap in teeth), muscles of back, breast and arms (arms are immovably fixed to sides of body, only left forearm functions slightly), and finally those of left thigh and hip and part of right thigh are ossified. Many muscles which are not ossified are atrophic, evidently in transitory stage, previous to ossification. No congenital abnormalities mentioned. Penis normal in size relative to age. Scrotum atrophied and testes quite undeveloped. Autopsy report, Mays,\* 1874. Very extensive autopsy in which several exostoses were found and most of the ossification diagnosed during life confirmed except in the cerv. muscles, especially in sternocleidæ mast. and the delt. and adjoining extensor musc. of the arm, which only showed a firm infiltration, together with development of the connect. tissue hyperplasia. Fingers and toes not examined. Spinal cord and periph. nerves found normal by Schultze.†

CASE XIX.—Reported by Edward F. Hamilton, in 1874. Female, aged 30 years (?). No clinical history obtainable. Subsequent course of disease unknown. Body brought to Medical School of St. Stephen's Hospital. Body inclined to left side; head bent forward, arms closely applied to sides; forearms flexed and pronated. No motion of shoulder-joints nor of scapula upon trunk. Left side of thorax contracted; right ilium nearly in contact with ribs. Lower limbs flexed and adducted, right leg and foot much inverted; ankle joints stiff. Skeleton showed: Along anterior border of left masseter a ridge of bone preventing any movement of jaw. Head immovably joined to upper cervical vertebræ. Spinal column forms one solid mass; cervical, dorsal and lumbar vertebræ firmly joined by copious bone deposits; left shoulder-joint perfectly stiff and large plate of bone fixed to humerus near insert. of pector. maj. reached up to coracoid proc., then down and inward till identified with costal cartilage. Connecting the shaft of right femur and trochanter immense osseous growths resembling stalactites had formed, branched into the fibres of extensor muscles. Similar growths were upon dorsum of ilium. Osseous deposits at patellas, insert. of quadriceps, extensor, tendon and many ligaments of soles of feet had ossified. Between muscles of back from occipital bone to inferior angles of scapula and down to crest of

\* Op. cit.

† Op. cit.



## MYOSITIS OSSIFICANS PROGRESSIVA

ilium. Consolidating hip-joints were enormous plates of ossific matter; in front of left femur osseous deposits bearing resemblance to a second femur. This deposit had been formed in cellular tissue between rectus femoris and cruræus.

CASE XX.—Reported by Bennett, in 1874. Female, aged 11 years. Family history negative. First symptoms appeared in infancy—swellings over shoulder and back of neck. Irregular attacks over various parts of body. On right side from protuberantia occipit. to supraspinous fossa a bony growth is stretched, apparently situated in trapezius, irregular masses of bone are deposited in location of rhomboid muscles, and bony processes branch upward and inward from latiss. dorsi, portions covering scapular angles, other branches going down from those to crest of os ilium. Across middle and upper parts of loin transverse osseous bars have developed following the course and fibres of the muscle. A spur has commenced to grow from either ulna near attachment of pronator quadratus. No congenital abnormalities mentioned. Cast of girl demonstrated.

CASE XXI.—Reported by Dittmeyer and Gerber, in 1875. Female, aged 8 years. Family history negative. First symptoms appeared at 6 years of age—complained of pains in right side of nape of neck and shoulder. Stiffness of neck and right shoulder; some difficulty in breathing. Right shoulder grew immovable, breathing became more difficult. The left shoulder stood higher, head had been drawn toward left side. Right trapezius muscle stiff and hard, so that the head could not be moved to either side. The supraspinati and teres minor grew as hard as a board and arms were tightly drawn to sides of thorax. In serratus post. super. one could feel the daily spread of the ossifications along the separate muscles. All other muscles were free. No congenital abnormalities mentioned. General health, with exception of the difficult respiration, was good; all organs functioned well. Autopsy report, Mays.

CASE XXII.—Reported by V. P. Gibney, in 1875. Female, aged 10 years. Family history negative. Attack of diphtheria (?). First symptoms appeared at 10 years of age—had been perfectly well up to attack of diphtheria. Subsequent course of disease unknown. Muscles involved were latiss. dorsi, scaleni and erector spinæ. Right arm was held down by tendon of latiss. dorsi. Also lateral curvature. No congenital abnormalities mentioned. No mention of microdactylia. At suggestion of a colleague acid. lact. was given, with no amelioration of symptoms; but there was no further progress during the next year and a half of observation. Seen again in 1893. Had been working in a millinery shop since 1884. No change of status. (Doubtful case.)

CASE XXIII.—Reported by Huth, in 1876. Male, aged 4 years. Family history negative. First symptoms appeared at about 2 years of age—hard spots under chin. Gradual extensions toward angles of lower jaw; then chest and other parts of body. Hard swelling size of egg developed over middle of sternum at about 2 years of age. It disappeared again. On shoulder and both upper arms swelling and hardness developed. In the spring of 1874 a swelling appeared on forehead, extending over eyelids, eyes being entirely closed. This disappeared again. Upper arms lying closely to trunk and fixed; lower arms movable. Head, neck and thorax muscles hard and stiff like armor. Both glutæi, especially of left thigh and leg, ossified. In abdominal muscles a cord thick as finger running from angle of ribs to os pubis. No congenital abnormalities recorded.

CASE XXIV.—Reported by Nicoladoni, in 1878. Female, aged 7 years. First symptoms appeared the first year of life—stiffness in muscles of neck. Later stiffness in muscles of back. At present two hard ridges corresponding to sacrolumbales. The scapular muscles are ossified so that the shoulder-blades are immovably fixed to thorax. At upper part of biceps brachii are small bony plates in various parts of the muscle, its tendons changed to hard fibrous cords. The same changes present in sternocleidomastoidei. The contracted right knee-joint can only

## JULIUS ROSENSTIRN

be extended to 120°. Semitend. and membranos. changed to two hard lumps. Pectorales also ossified and the axillary fossæ are bounded in front and posteriorly by rigid walls. The muscles of the lower jaw are also involved. No congenital abnormalities recorded.

CASE XXV.—Reported by H. Helferich, in 1879 and 1883; Carl Mannz, in 1893, and Arthur Manneberg, in 1896. Male, aged 16 years. Family history neg. First symptoms appeared at 6 years of age—numerous hard nodules appeared upon head and gradually disappeared again. Later similar painful nodules appeared on back; arms and back became stiff. Between the twelfth and thirteenth years slow development of closure of jaws; first right molar had to be extracted to allow feeding. When 15 years old could still push out tongue between teeth. Jaws now firmly closed. Arms gradually became stiff and nodules developed all over them. Axillary fold hard; masseteric region hard ridges from the process. zygomatic to lower jaws. Jaws locked. Neck in region of hyoid bone hard, but bone and larynx movable. Thorax, pector. maj. shows ossified swellings. Back, swellings of osseous hardness spreading like antlers from pelvis upward. Right hip immovable; left hip normal; left gluteal region, flat resistant bone-hard mass; abscess developed in right inguinal region. First case where attention was drawn to microdactylia of thumbs and big toes in this disease, although anatomical defect was erroneously thought to be defect of an entire phalanx instead of smallness of metacarpal or metatarsal bone. In later observation (1887) it is reported that case had remained fairly stationary since first observation. In latest observation (1896) by Manneberg, quite an additional progress is noted, comprising old and new muscular groups.

CASE XXVI.—Reported by Partsch, in 1882. Male, aged 17½ years. Family history neg. First symptoms appeared at 10 years of age—swelling after fall on right shoulder; disappeared again, but hardness remained in right side of neck. Developed stiffness of muscles, which affected right shoulder and upper arm; later left arm; after fall on and wounding forehead a swelling of os frontale followed. Two years ago muscles of left side of neck hardened and drew head over to left side. About same time ossification of masticating muscles set in so that mouth can only be opened 1 cm. Head bent to left and fixed forward; both arms flexed in elbow-joints, right cannot be approached to body, left only with great exertion. Both shoulders fixed. Cervical column rigid. Sternocleido fibrous, but no bony enclosures. Scaleni show osseous changes. Right scapula carries a small roundish osseous tumor 4 cm. long, 2 cm. broad; lower border of left latiss. dorsi entirely osseous. Left brach. ant. contains osseous growth. Right latiss. dorsi shows osseous growths extending to upper arm and triceps. In back: two osseous plates (11 cm. long), one in each fascia lumbodorsalis. Exostoses 1½ cm. long near right spin. ant. os. il. Broad bony plate in right tens. fas. lat. and narrower one in right sartorius. Similar one 3 cm. broad and 13 cm. long in left sartorius. Microdactylia of thumbs and big toes.

CASE XXVII.—Reported by Herm. Kuemmel, in 1883. Male, aged 13 years. Family history neg. First symptoms appeared fourteen days after birth (congenital)—foster-mother then observed striking deformity of spine and back and restricted mobility of both arms, which could only be slightly abducted from thorax. In second year various fluctuating swellings were observed upon back. They shrank and hardened into exostoses. Except some hardening of more swellings no particular change occurred until twelfth year, when gradual contraction of left knee-joint began. Head inclined forward and slightly to right side; movements very restricted. Small exostosis on occiput. Arms hardly movable from sides of thorax; upper part of body bent forward and curved. Floor of oral cavity forms callous mass, including os hyoid, and thyroid cartilage. Both sternocleidi and sterno-hyoid fibrous. Entire cervical spine bent forward and forms one continuous solid mass. Ligam. nuchæ much thickened. Costal cartilage forms pectus carinat. In both

## MYOSITIS OSSIFICANS PROGRESSIVA

pectorales major, bony bars extending in right to coracobrachialis. Both axillary posterior walls contain bony bars. In right rect. abdomin. tough fibrous and thin bony band. Both psoas tough callous masses. Dorsal scoliosis to right, lumbar to left. From seventh dorsal vertebra downward processus spinos. form one solid osseous mass. Both large trochanters broadened and prominent. Muscles of left thigh posteriorly changed into tough callous mass, with freely movable bony protuberance. Left leg flexed, angle of 45 degrees. Both thumbs nearly (?) normal; show bony ankylosis in interphalangeal joints. Microdactylia of both big toes ascribed to absence of first phalanx. (Real cause is probably smallness of metatarsal bone.)

CASE XXVIII.—Reported by Uhde and Pinter, in 1883. Male, aged 16 years. Family history neg. First symptoms appeared first year of life—swellings on head, which disappeared after some time. Patient broke arm in 1876. Fracture healed perfectly and shows *hardly any trace* of callus. Head and shoulder joints bent forward; arms ankylosed in shoulder joints; movements in elbow joints limited only. Ankylosis of interphalangeal joints in both thumbs. Microdactylia of both great toes (with same probable error as above).

CASE XXIX.—Reported by Krause and Pinter, in 1883. Female, aged 11 years. Family history neg. First symptoms appeared soon after birth—swellings in several places on scalp, which disappeared again after several months. At age of 4 years swelling in some of the deeper muscles of that region. It spread rapidly, then decreased, but left board-like hardness, fixing scapula firmly to thorax. Short time after same process occurred on right side. Disease progressed to left latiss. dorsi and biceps brachii, part of intercostals and serratus. Two years ago right mylohyoid, geniohyoid and part of biventer followed with swellings, which, disappearing, always left board-like hardness with spinous growths 1.38 cm. tall; circumference at mamma 62 cm. Slight kyphosis, convexity at seventh dorsal. Left shoulder completely stiffened. Deltoid atrophic. Biceps ossified, fixing elbow in slight flexion. Broad flat from spine to angle of scapula, two larger on right. Over scapula and thorax flat exostoses. Left latiss. dorsi totally ossified. Ribs below fourth rigid and unyielding. No mention of microdactylia.

CASE XXX.—Reported by Gyula Pinter, in 1884. Female, aged 20 years. Family history neg. First symptoms appeared at 4 years of age—hard nodules on back and disturbances of mobility of both shoulder joints. Patient does not remember ever having been able to lift arms above shoulders. At 6 years abduction of arms became so restricted that she could not write when seated at school desk. Other joints remained free until twelfth year. About the twelfth year, during formation and healing of suppurating swelling over right tibia, nearly all her joints lost greater part of mobility. In 1881 another suppurating swelling appeared on left leg, with a similar injurious effect on the various joints, rendering them still more rigid. When lying in bed rigidity of body like that in tetanus. Head; caput obstipum nearly immovable; chin held out and downward; ankylosis of lower jaw-bone; only lateral excursion of about 2 mm. in horizontal plane possible. Both temporales and masseters of bony hardness. Thorax absolutely immovable during respiration, owing to complete ossification of both pectorales major and minor. Axillary fossae rigid walls; both cucularis ossified. A bony ridge 2 cm. broad, extending in middle line of back from prominentia occipit to seventh cerv. vert. Back and arms, two bony ones on either side of ninth and tenth dorsal vert. Left 10 cm. long, 2½ cm. wide, sends branches toward left scapular angle and down to crista ilei. Right, 6 cm. long and 2 cm. wide, sends similar branches anastomosing with other side. All firmly united with underlying parts of skeleton. Shoulder-blades immovably fixed to trunk. Stalactites of bone in ant. and post. muscles of both upper arms, and in left pronator teres and radial ext. Pelvis and legs, exostoses 3 cm. long on both crist. near ant. sup. spine. Hip joints immovable; muscles origins from both tuber. and ram. asc. ischii and trochant.

# JULIUS ROSENSTIRN

maj. all ossified. Bony ridges in lower halves of bic. fem. and semitend. and membr.; muscles of lower legs and feet free. Microdactylia of both big toes.

CASE XXXI.—Reported by O. Kohts, in 1884. Male, aged 23 years. Family history neg. First symptoms congenital. Could not move since his ninth year, having then made his first attempt to walk. Severe pains ensued after he first tried to walk, which made him take to his bed until his fourteenth year, when he entered the hospital. Patient 141 cm. tall. In bed could not change his position. Head and trunk slightly bent forward and to right. Lower jaws ankylosed. Masseter and pterygoidei apparently ossified. Exostosis 2 cm. long on inframaxillary bone. Ligam. nuchæ and muscles cucullar. and splen. partly ossified. No thoracic respir. movement. Both clavicles show large exostoses. Shoulder joints ankylosed. Both maj. and minor pectorales contain bony plates; entire lower margins ossified. Both arms firmly fixed to thorax. Both coracoid muscles and left brach. int. ossified. Right elbow-joint ankylotic. At fourth rib exostosis 2 cm. long. Left elbow limited mobility. Muscles coming from right condyl. int. humeri ossified in upper parts. Both hip-joints ankylotic. Deep glutæi and insert. of right quadrat. ossified. Left tens. fasciæ and tendon of right biceps femur and insertion of right gastrocnemius contain bony plates. Spinal column scoliotic; vertebr. column ankylotic; muscles along both sides atrophic and ossified. No mention of microdactylia.

CASE XXXII.—Reported by T. Sympson, in 1886, and Stonham, in 1892. Male, aged 6 years. Father rheumatic and presents same congenital deformity of toes as son. Fell on shoulder when 5 years old. First symptoms appeared at 5 years of age—painful swelling formed on right shoulder after fall one week earlier, then shrank gradually; three months later a similar swelling appeared on left scapula. Various swellings formed and disappeared again on back and chest. Jan. 16 (at demonstration) saddle of bone over loins, making stooping impossible. Margin of each latiss. dorsi, of each teres major and long head of r. triceps were occupied by a series of lumps apparently bony; similar lumps present a little below occiput in left trapezius, the middle of neck and on right side, and on supraspinous fossæ. Six years later (1892) two bones size of filberts found on inner side of post. sup. spine of r. ilium. Patient fell Aug., 1887, and broke both bones of left forearm. Fracture united well. A firm hard swelling involving left vastus ext. and int., extending from just above patella upward for about four inches, consequent to a fall upon the knee. A similar swelling posteriorly in the popliteal space, biceps and semitendin. Motion of knee limited. A nodule size of filbert in middle of inner side of left thigh, situated in sartorius muscle. Feet show head of each metatarsal bone large and prominent; big toe on either side small and apparently consists of only one phalanx (?) and is directed toward outer border of foot. (No X-ray.)

CASE XXXIII.—Reported by Willett, in 1886, and Stonham, in 1892. Male, aged 4 years. Family history neg. First symptoms appeared at 6 months of age—swelling at superior angle of right scapula. When 1 year old swelling along vertebral border and inferior angle of right scapula. Six months later prominence noted in left erector spinæ and a little later a swelling near lower angle of left scapula. Right frontal eminence enlarged. Hard growth over left transverse processes of fourth and fifth cervical vertebræ. Right lateral dorsal curvature of spine, with slight compensat. curvature in lumbar region to left. Slight kyphosis of upper dorsal spine. Both scapulæ fixed. Hard growth along vertebral border of right scapula. Latiss. dorsi at scapular angle and in its tendinous portion ossified. A similar, less extensive hardness on left scapula and latiss. dorsi. A bony nodule on front angle of eighth rib, similar on left. Both erectores spinæ ossified. On right knee just above head of fibula hard mass 1 inch in diameter, with nodule size of pea. Inner tuberosity of right tibia slightly thickened. Both big toes hallux valgus position, displaced outward and under second toe. Shortened microdactylia, only ungual phalanx present



## MYOSITIS OSSIFICANS PROGRESSIVA

on each side (?). In Stonham's subsequent report six years later no correction of this statement of a very unusual condition is made.

CASE XXXIV.—Reported by Rickman J. Godlee, in 1886. Male, aged three years. Family history neg. First symptoms were noted when 1 year old, but may have been present long before, as nothing was learned of previous history from parents—bony plates in right latiss. dorsi and a nodule near right knee. Was not seen again till two years later, when present status was noted. In r. latiss. dorsi along outer border and post. fold of axilla, irregular bony mass; arm cannot be abducted more than sixty degrees, but can be completely adducted. Flexion of shoulders considerably limited; extension less; rotation inward more than outward. On left side post. a large elastic mass extending medially to nearly within the middle line and considerably below scapula, and upwards over shoulder to near clavicle. Scapula appears fixed in mass below angle. This mass had disappeared on March 23, 1886, but there is a hard mobile mass below left angle. Similar hard bodies, apparently bony, not movable, on free edge of left latiss. Seen again May 20, 1886; over the fourth rib, behind in post. axillary, ossifications. Over third rib in posterior axillary line, similar ossifications. Shoulder cannot be raised to right angle. Head drawn down to left shoulder. Some hard masses in muscles on outer side of neck (trapez. and right mast. excepted). Left arm cannot be raised higher than 45 degrees from trunk; scapula firm. In post. axillary fold hard nodulous mass. From angle of scapula a hard crest runs over to first lumbar vert. Back strongly curved; lower left ribs down on crest of ilium. Pollex valgus and microdactylia of thumbs. Hallux valgus and microdactylia of toes.

CASE XXXV.—Reported by R. v. Volkmann, in 1887. Male, age (?) Skeleton. Subsequent course of disease unknown. Various parts of his muscular system had been partially substituted by bony masses, which had grown into them. V. Volkmann had made attempts by removing some of them to restore a certain movability of ankylotic and immovable parts of the skeleton. The only published mention of this patient is made in a brief and vague reference in a discussion of Helferich's case. The extirpated bony masses showed at one end an epiphysial layer of hyaline cartilage.

CASE XXXVI.—Reported by Alfred Austin London, in 1887. Male, aged 43½ years. Family history neg. Accuses slight blows when 10 years old. First symptoms appeared at 10 years of age—joints of legs and shoulders stiffened. Gradually until his thirtieth year grew quite stiff and helpless. Jaws could only be opened very little. Over sacrum a bed sore formed from which pieces of bone were constantly exfoliating. Ossification of deltoid from acromial origin to insertion; also part of coracobrachialis. Scapulae immovable on trunk, their inferior angles soldered by dorsal buttress of bone attached by seventh to ninth ribs. Latiss. dorsi ossified nearly entire lengths. Ossification of left brachialis anticus, and bony rims around both elbow-joints. Sacro-iliac ligament ossified. Both hip-joints ossified. Bone rods developed in lower part of glut. max. and extending from sacrum to femoral insertion. Huge bony projection on back of femur. Dorsal lumbar curve, with slight rotation to right. Very rigid, due to ossification of the capsular ligaments of the articular processes and many of the supraspinous ligaments. Died at age of 46. Microdactylia of both big toes. (No mention of thumbs.) General synostosis of the neural arches. All the ribs except the eleventh and twelfth are ankylosed to vertebral column. Bones have undergone eccentric atrophy and are consequently rather light.

CASE XXXVII (?).—Reported by E. Schwarz and Cl. Eichhorst, in 1888. Male, aged 40 years. Family history neg. First symptoms appeared at 39 years of age—a hard mass in posterior muscles of thigh. Subsequent course of disease unknown. Exostoses also on right humerus and on right femur in the region of the trochanter minor. Hyperostosis of right fibula. Suffers from tabes dorsalis. This case, as well as another from Eichhorst's clinic, both affected with spinal diseases. Do not belong to myositis ossificans progressiva. No microdactylia.

CASE XXXVIII.—Reported by Kronecker, in 1889. Male, age (?) First symptoms

# JULIUS ROSENSTIRN

appeared in (?) later years—first pains in nape of neck and in chest, two years previously. In November of the previous year the scaleni became affected. Since one year dyspnoea increasing; the cucullares are involved and the process is evidently progressing. Patient has pains in neck and one feels distinctly the increasing ossification. No microdactylia. (Doubtful, atypical case.)

CASE XXXIX.—Reported by J. v. Bokai, in 1899. Male, aged 5 years. Family history negative. Rickets. First symptoms appeared at  $4\frac{1}{2}$  years of age—nape of neck and back. Subsequent course of disease unknown. Muscles of nape of neck, back and serrat. anticus maj., pectorales maj., cucullaris and latiss. dorsi are affected. No congenital abnormalities recorded.

CASE XL.—Reported by Ivar Svensson (Sabbatsberg Hospital), in 1891. Male, aged 14 years. Family history neg. Fell when 4 years old (?). Age of first symptoms unknown—stiffness of body, arms and back. Stiffness has been gradually increasing. Stiffness of head and back and arms. Scoliosis on nape of neck; these are hardened and flattened and atrophied about the level of the levator anguli scapulæ, with fixed shoulder-blades; arms cannot be raised more than one-fifth of right angle from thorax. Otherwise arms can be lifted to horizontal plane, but not higher. Passive efforts to overstep this give crepitation and pain. In the height of axillary fossa a flat piece of bone of about 7 cm. length and 2 cm. width intimately connected with the tendons of latiss. dorsi and teres major and to the edge of the scapula. At the inner sides of both scapulæ parallel with spine one can palpate a round bony formation of 5 cm. length and hardly 1 cm. width. No mention of microdactylia in either fingers or toes.

CASE XLI.—Reported by C. Studsgaard, in 1891. Female, aged 4 years. Family history neg. Measles and whooping cough when 2 years of age. First symptoms appeared at 2 years of age—noticed swelling after measles and whooping cough. (Where?) First swelling (where?) disappeared again during use of cod-liver oil. Growth of bony consistency appeared after another year without any cause on the left side of the neck, rendering movements of the neck, especially downward, very difficult. Diffuse osseous swelling appeared on left lower jaw like convex continuation, cylindri-form, size of finger, from base of that bone in region of premolar to incisura semilunaris sterni, and firmly attached to left horn of the corpus ossi hyoidei with one end, with the lower movably connected with sternum. Slight movements of maxilla are still possible, also small side motions of the head. The mass is situated anatomically as if it were as ossification of the sternohyoid muscle, wherefrom the bony part continues to the lower jaw. Bone of neck extirpated February 4, 1891. Dismissed March 20, 1891. New bone formation on location of extirpated bone from neck. Microdactylia of both thumbs and large toes and ankyloses of their phalanges.

CASE XLII.—Reported by R. Gordon McDonald, in 1891. Female, aged 4 years. Family history negative. First symptoms appeared at 2 years of age—lumps appeared on left side of neck about middle of sternocleid. Later on lumps appeared on forehead and back (dorsal vertebræ). All lumps disappeared after some time. Head fixed; unable to move it; sternomastoid, trapezius, stylohyoid, omohyoid and sternohyoid ossified. Over left frontal eminence a large node; smaller one over left temporal bone and right border of occipital. Both elbows can be moved only eight inches from trunk; teres major, latiss. dorsi, edge of pectorales major becoming gradually ossified. Scapulæ fixed to ribs, right less than left. At inferior angle of both scapulæ large nodes; on left superior angle a similar one; right side free. Various-sized nodes along the vertebral spinæ from head to sacrum, also along lateral parts of several ribs and over crest of ilium. The superficial muscles of back are gradually ossifying. Ribs are also becoming fixed and she is unable to take deep inspiration. Teres major was, experimentis causa, exsected during hospital stay. It was totally ossified. Result as to mobility—none. No congenital deformity mentioned.

CASE XLIII.—Reported by Bilton Pollard, in 1892. Male, aged 9 years. Family

## MYOSITIS OSSIFICANS PROGRESSIVA

history neg. First symptoms appeared 6 months of age—lumps formed on lower angle of right scapula and nodules appeared on boy's ribs. In second year neck was getting stiff. In third year lumps formed between right iliac crest and the last rib. In his fourth year hard nodule formed a little below patella after fall on right knee. New lumps formed, his left arm stiffened and bony bands appeared in his neck up to his seventh year, but none during his seventh, eighth and ninth years. Neck quite stiff; rotation and raising of head barely possible. Bony band between chin and sternum extending from the lower border and from the right of lower jaw to right side of cricoid cartilage, there dividing into two, the right ending just above sternoclavicular articulation, left above clavicle between the two heads of left sternocleidomastoid. R. arm can be raised to angle of 45 degrees only together with scapula. Axillary folds contracted. Scar there from bony operation five years ago. Beneath it bony plate slightly movable, apparently in latiss. dorsi. Pectorales and deltoid hardened; hard mass on border of radii two inches above styloid process. L. arm equally stiff. In course of teres major runs thick band of bone, extending free from inferior scapula angle almost to humerus. Bony projection at left-elbow bend connected with biceps tend.; another mass a little deeper down involving brach. antic. Spine very rigid, and on both its sides bony nodules and plates in dorsal and lumbar regions. On outer and post. part of r. thigh flat osseous plate; smaller plate on left. On each thigh strong bony spiculae, extending from adductors tubers. upward to tend. of adduct. magnus for about two inches. Irregular-shaped movable plate between lower fold of left condyle of femur and patella and a smaller one near outer tuberosity of tibia. Inner borders of both tibiae show bony growths just below tuberosities. No congenital abnormalities mentioned. Pieces of bone were excised to improve mobility of arm and neck, but they soon formed again, and the slight improvement gained by the operation was lost.

CASE XLIV.—Reported by Luigi Bernacchi, in 1892. Male, aged 7 years. Family history neg. First symptoms appeared at 3 years of age—muscles stiffened in nape of neck without inflammatory symptoms. Small hard tumors formed in right cucullaris over tuberosities of frontal and parietal bones. About a year ago stiffness of humero-scapular joint appeared. Left arm could not be raised above horizontal line. New hard osseous growths have formed along the spinous processes of dorsal vertebrae, and growths in lumbar muscle so as to form line from neck to os sacrum. Two cervical projections over frontal tubera. Head slightly inclined forward and to the left; movements restricted. *Neck and back*; from the occipital insertion of right trapezius near middle, irregularly formed osseous tumors forming one solid mass of muscles. *Thorax and abdomen normal*; small exostoses above styloid process of radius. Posterior wall of axilla shows fibrous consistency and is shorter than normal. The scapulae are united by bony ridge about their middle; an osseous tumor within the dorsalis major can be felt, size of thumb and somewhat movable. No mention of microdactylia. (Photograph of boy shows indication of microdactylia of thumbs.) No mention made in text.

CASE XLV.—Reported by Ludwig Rabek, in 1892. Female, aged 3½ years. Family history neg. First symptoms appeared at 6 months of age—hard nodules in region of shoulder-blades. Parents noticed movements of upper extremities were restricted; movements of lower jaw have been impeded since one year before. Difficulty and restriction of movements of lower jaw and both upper extremities. The distance ad maximum between the front rows of teeth is only 0.5 cm. Right masseter hardened and hypertrophied. The arms cannot be raised to horizontal line. Right elbow-joint contracted, extension incomplete, flexion normal. Shoulder-blades only slightly movable. Osseous tumors arise on many parts of the body, mostly on back. Large one in right axilla extends to latiss. dorsi as far as scapula line of tenth rib. Another on left side reaches eighth rib. There are four more in the scapula and one in lumbar region, all in the muscles. Right biceps changed into hard movable

## JULIUS ROSENSTIRN

mass united with shoulder muscles. Small pea-sized nodules in right pectoral. Big toes of both feet contracted outward and downward so that each lies under the second toe. (Microdactylia and hallux valgus.) Congenital deformity.

CASE XLVI.—Reported by J. Brennsohn, in 1892. Male, aged 20 years. Family history neg. First symptoms appeared in early childhood—a certain clumsiness of motion and elevation of right shoulder. Later a scoliosis, and three years ago right arm grew stiff, then left arm, then the trunk and subsequently the legs. Had to give up work in factory. The muscles of the posterior cervical region are completely ossified; all the anterior muscles feel rigid, especially the scaleni and right sternocleido; below the right lower jaw the mylohyoid forms a bony growth like a stalactite. Mobility of head nominal; shoulders quite stiff; arms cannot be abducted from side of thorax. Left elbow-joint ankylotic; right only partly movable. Both anterior and poster. walls of axillæ ossified; also deltoids, serrati antici maj. and intercostales. The lower parts of left biceps and brachialis indurated and tense. Hand- and finger-joints free. Ramified osseous growths from both cristæ ossis ilii into both glutæi max. Some mushroom-like exostoses from left crista ossis ilii. Both big toes microdactylic (metatarsus primus?) and in valgus position. Brennsohn ascribes it to missing of basal phalanx. No X-ray taken.

CASE XLVII.—Reported by V. P. Gibney, in 1893. Male, aged 10 years. Family history neg. First symptoms appeared at 5 years of age—was admitted to the hospital at this time to sever a strip of ossified muscle, but was removed by parents before operation. Subsequent course of disease unknown. Head tilted to right; upper extremities bowed so that thumbs touch elbows of opposite side; elbows abducted from trunk; shoulders stiff; right clavicle has extra curve at outer half; greatest convexity posteriorly. Left clavicle curved entire extent; convexity toward neck. From its middle springs irregular bony mass elevated half an inch. Base of this mass spreads in clavicular portion of pectoral. major and continues in its pectoral part, terminating in anterior wall of axillary space. Over sternal articulation of second rib small exostoses tapering off into pectorales mass. Similar ones over sternal end of third and fifth ribs. None on right; about middle of fifth rib, just in front of axilla, a bony enlargement extending back and downward, involving the whole area of latiss. dorsi and serratus magnus. March, 1893; the bony tendon of the right latiss. dorsi was divided and a piece of bone about one inch wide was excised, but new bone was thrown out and rendered void the effect of the operation. An osseous tumor the size of a peanut over tendo achillis which was removed did not return. No mention of microdactylia. Private advice kindly given me says that author failed to take notes about presence or absence of microdactylia.

CASE XLVIII.—Reported by R. Virchow, in 1894, and Bollinger, Linsmeyer, Kraske, Wollenberg, A. Weil, Nissim and Weil, Faulkner, Lyon, De la Camp, Ponfick, Birch-Hirschfeld. Male, aged 29 years. Family history neg. First symptoms appeared at 18 years of age—swelling and pain in maxillary articulation. Pain, swelling and final ankylosis of maxillary and various joints of extremities. Osseous masses on both sides of median line of neck. Bony elongation from right process coracoideus extending along tendon of that muscle and of the short head of the biceps for about 5 cm.; somewhat less on the left side. Ankylosis of right shoulder-joint. Ossification of right triceps extending upward to teres and dorsalis muscles, also some ossification in anconeus. Small cartilaginous nodules on the tendons of abductor longus and extensor brevis pollicis. The left arm shows the same changes as the right and a cartilaginous, fork-like formation over elbow-joint. Irregular osseous masses in upper part of trapezius and over lumbar region projecting at various angles and of varying sizes. Bony formations project from the sacro-iliac articulation to the right and left sides, reappearing in the iliac fossæ and extending to the coxofemoral joints, which they immobilize, reaching to the great trochanter and into the muscular insertions thereon. Thickening of tuberosity of right tibia; exostosis of head of astragalus.



## MYOSITIS OSSIFICANS PROGRESSIVA

Heads of metatarsal bones thickened as in arthritis deformans. Left leg shows similar changes as right one; osseous mass extending from popliteal fossa down between the two bones and immobilizing knee-joints. Thickening and ankyloses of ankle-joints. Ankyloses of big toes; from the tip a long bony appendix is branching off, size of a walnut, like a supplementary toe. In the discussion of this case Gerhard drew attention to the microdactylia of a big right toe. Case began rather late in life, but except this one symptom, has all the earmarks of the disease. The epiphyses of the long bones are so soft that pins can be pushed into them.

CASE XLIX.—Reported by A. A. Kisel, in 1893, 1906-1909. Male, aged 1 year and 7 months (13 years?—16 years?). Family history negative. First symptoms appeared at 1 year of age—swelling in nape of neck size of small walnut; no accompanying pain or inflammatory symptoms. After three or four weeks most of tumors disappeared without leaving any trace. Some others seemed to soften and discharged a puriform liquid. All without symptoms of inflammation. *Later*, head has been drawn forward and posterior part of neck has become very rigid and quite immovable. Impossible to turn head backward. Head drawn forward. Chin touches thorax. Motions of head very limited. The entire posterior part of neck appears considerably swollen; the borders of the muscles very much thickened. The sterno-mastoid and pectoral muscles present some changes. Movements of right shoulder very limited, especially abduction and elevation. April 25, 1893, a new tumor appears in the right flank, with the same character as the others and reaching size of a small walnut. When 16 years old bone-like hardening of ant. and post. cerv. muscles, muscles of thorax, scapulæ, shoulders, abdomen, osteal attachment between twelfth rib and crista ili; exostoses on lower jaw and scapular spine; head inclined forward and to the left, and immovable; head, vertebræ, neck, thorax and upper extremities in shoulders all one mass of bone; limited movement in elbow-joint. Improvement at first under K. J. At 13 years walked well, but now unable to leave bed. Extirpation of small tumors; tumor shows muscle cells much swollen, reddish-yellow and cedematous. Microscopical examination; very young embryonic tissue cells large star-shaped cells with various-formed processes; very few striated muscle fibres, very much modified. Microdactylia of both big toes, with aplasia of first phalanx.(?)

CASE L.—Reported by Weldon Carter, in 1894. Male, aged five years. Family history neg. First symptoms appeared at 4 years of age—lumps in back. Never any complaint of pain or tenderness or inflammatory symptoms. Back and shoulders affected, especially latissimi dorsi. Both big toes in hallux valgus position; the phalanges of fourth and fifth toes were very short and slight webbing between second and third toes of each foot.

CASE LI.—Reported by Carl Hochhalt, in 1894. Male. Family history neg. First symptoms appeared at 19 years of age—pains and swelling in right triceps brachii. Pains and swelling gradually disappeared after three months, leaving osseous hardening; similar attacks repeated annually, involving new groups of muscles. Spinal column is rigid and ankylotic in all its articulations. The muscles of the back are changed into hard bony plates, especially both cucullaris and latissimi dorsi, exostoses trunci; mimic muscles of face intact, masticating muscles rigid. In order to allow nutrition patient had several teeth broken out. Pushes nourishment through gap. Both shoulder-joints stiff, both triceps changed into hard bone masses. Under left gastrocnemius large bony mass size of one and a half fists reaching partly up into popliteal fossa, contracting knee-joint. Left glutæus changed entirely into shapeless bony mass. No congenital abnormalities mentioned.

CASE LII.—Reported by E. Lexer, in 1895. Male, aged 50 years. Family history neg. First symptoms appeared at 35 years of age—pains in left side of chest. Pains disappeared after three weeks, leaving soft-covered nodules the size of hazelnuts at the painful places. These nodules also disappeared after a short time. In 1884 again pains in left side of chest and back. Soft swelling in left lumbar region size

## JULIUS ROSENSTIRN

of palm of hand. Later grew smaller and harder. Till 1888 recurrence of symptoms every summer. The lumbar swelling grew larger and harder and spread in front and upward to the axillary line. He again fell sick in 1890, then remained free until 1894. New nodules had formed and a very severe recurrence took place, with pain in both shoulders and in muscles of both upper arms. In the lower part of the pectoralis major a cartilaginous nodulous tumor, size of a hen's egg. At the margin of the trapezius muscle, level of sixth cerv. a similar but smaller tumor. On the left deltoid a growth size of a man's fist, of fibrous consistency, covered by muscle and slightly movable over the underlying bone. Both upper arms show under atrophic biceps a cord-like, bone-hard mass, movable on humerus and occupying the place of the brachialis internus. The right forearm shows in its middle a bone-hard growth about 5 cm. long and wide, movable sideways under the supinator longus. Some of the other muscles show peculiar indurations. In the back the left latiss. dorsi nearly entirely pronated by a tumor formed by the amalgamation of a number of smaller ones, which reach from the crista ilii to the vertebral column and up to the scapula. In the region of the left infraspinatus a very large free tumor from spina scapulae reaching to the acromion. In right serratus, over fifth and sixth ribs, a very hard flat tumor. No deformities of fingers or toes (specially mentioned). Excision of deltoid tumor. Ten days later the tumor over fifth and sixth ribs was excised. Patient left clinic December 6, 1894. Letter of March, 1895, mentions several muscles of neck and lower extremities involved. Microscopically the sections show acute and chronic inflammation and induration of the inter- and intra-muscular connective-tissue (perimysium) hypertroph. changes from which the formation of bone tissue starts. Atypical case. Commencement of disease very late. Ossification not shown.

CASE LIII.—Reported by Stephen Paget, in 1895. Male, aged  $7\frac{1}{2}$  years. Family history negative. First symptom appeared at  $4\frac{1}{2}$  years of age—swelling behind left ear. Since that time various swellings and growths have appeared, some disappeared again, while others remained in different parts of his body. Holds head in wry-neck position from contraction of left sternocleid. A small nodule of bone in the anterior edge one inch above clavicle. In each pectoral muscle irregular bony nodules moving with the muscles. In the right pectoral they are dispersed all through the substance of the muscle and continuous with plates of bone under the deltoid and along the latiss. dorsi. Latiss. dorsi contains a sharp bony ridge in the axilla; the serratus magnus shows hard nodules at its origin. The bony masses in the l. pectoral. are also continuous with bone in the fascia beneath deltoid. Along each side of spinal column a hard bony ridge, more marked on left than right side, seemingly part of latiss. dorsi. From ant. fold of each axilla a narrow hard cord, thickness of about No. 5 English catheter, runs right down the level of iliac crest; they are not bony. Both big toes are shortened and turned outward in metatarsal phalangeal joint, and the phalanges turn under the second toes. (Microdactylia-hallux valgus.)

CASE LIV.—Reported by Fuerstner, in 1895. Female, aged 15 years. Family history neg. First symptoms appeared at eight years of age—nodules size of pigeon eggs appeared and disappeared again after five or six weeks. Since the age of eight or ten months hindrance in motions of neck and arms from nodules appearing in these regions. Position of head and vertebral column stiff; rigid walk. All movements of head very limited through tension of hardened but nowhere nodulated muscles of the neck. In the long muscles of the back, however, there are several hard bony thickenings. At the inner margin of the scapula there are several osseous protuberances and bony plates in the latiss. dorsi. The arms are flexed most of the time; cannot be abducted, as tendons of pectorales major are hard cords. Both biceps muscles are hard as well as presenting a peculiarly sharp tendon; the lower parts of triceps feel ossified. On the left side the same changes are present in a lesser degree. Abdominal muscles and lower extremities show but slight changes.

## MYOSITIS OSSIFICANS PROGRESSIVA

During observation of this case a swelling occurred in the left biceps muscle within a few days. It was of a doughy consistency, the skin was slightly reddened and there was considerable pain upon pressure. A small piece of the biceps muscle was carefully excised and the *microscopical examination showed a very pronounced and intense hypertrophy of the interfibrillary connective tissue*, especially in the neighborhood of the blood-vessels, while the muscular tissue itself remained completely unchanged. Both thumbs and little fingers considerably smaller than normal. Microdactylia of both big toes.

CASE LV (?).—Reported by Eichhorst, in 1895. Male, aged 24 years. Family history neg. First symptoms appeared during time of observation in hospital—swelling and hardening of muscles of left calf. Subsequent course of disease unknown. The swelling extended from the upper end of Achilles tendon 5 cm. into the muscles of the calf. Skin at first red and inflamed, afterwards resumed its natural state. While the affected parts of the muscles decreased somewhat in size they so increased in hardness that they felt like bone; the skin was movable over them, and in so doing crepitation was distinctly felt. Patient had spina bifida. No change of condition was felt when patient left hospital or was observed later; no progressive ossifications in other muscles. No deformity of fingers or toes. This, as well as the former case reported by Eichhorst's assistant (No. 37), is a doubtful, atypical case.

CASE LVI.—Reported by O. Paget, in 1895, and W. P. Herringham, in 1899. Female, aged 5 years. Family history neg. Said to have suffered very intensely from rickets. First symptoms appeared three weeks before date of examination—lump in back, which gradually increased in size more rapidly since the last week. Subsequent course of disease unknown. Head fixed by two indurated nodules and hard sternocleido. Right pectoral, left pectoral and latiss. dorsi all in same condition. General health fair (pigeon-breasted); two growths, smooth, oval and firm, about 4 x 2" symmetrically on each side of vertebral column just below inferior angle of scapula. Similar growth, size of large walnut, attached to inferior angle of each scapula. Ossified node on external edge of right bicipital groove. Ossified node on forehead, the latter due partly to inability of child to protect itself when falling forward. Bilateral microdactylia of big toes ascribed to absence of first phalanx. Observation in 1899 shows marked progress of disease on skull, abdominal walls and both ulnæ; movements of shoulder very restricted. Skiagram of big toes shows microdactylia and hallux valgus, due to: (1) Irregularity and shortness of metatarsal bones; (2) thickening of outer side of first phalanx, tilting bone outward; (3) synostosis of the first and ungual phalanx at oblique angle. Exostoses on first phalanx of the right middle finger.

CASE LVII.—Reported by Harry Lockwood, in 1896, and Raymond Crawford, in 1899. Male, aged 4½ years. Family history neg. First symptoms appeared at 2½ years of age—German measles shortly before malady showed itself. Subsequent course of disease unknown. Body and head bent forward. Masseters hardened; right and left pectorales major ossified and fixed. Large masses of hard material on both sides of spine. Microdactylia of thumbs and toes.

CASE LVIII.—Reported by Zöge v. Manteuffel, in 1896. Subsequent course of disease unknown. Demonstration of a skeleton of a case of myositis ossificans progressiva, where the products of the disease could be seen from head to foot. The osseous neoformations correspond to the course of the muscles. They had developed in their connective tissue nearly everywhere independently of the skeleton, so that they could not be ascribed an exostoses. A synostosis of the shortened phalanges of the big toes. The thickening of the mandibulæ seemed to be caused by an ossification of the muscular insertions. Microdactylia.

CASE LIX.—Reported by Ludwig Pincus, in 1897. Male, aged 25 years. Family history neg. When 13 years old fell on back from a height of two metres. First symptoms appeared at 14 years of age—observed in nape of neck two little

## JULIUS ROSENSTIRN

nodule-like glands, but they disappeared later spontaneously. Later back, shoulders and left arm again attacked after trauma. Causes of attacks are generally traumatic. After a prolonged quiet an attack of violent pains and swelling, first on the left, then on the right side. Disease particularly pronounced in neck, back and surroundings of neck, surroundings of axillary fossæ, masseters, upper arms and thighs. Scoliosis, caput obstipum, exostoses and hyperostoses. The right carpo-metacarpo articulation pollicis ankylosed; thumb smaller than normal. Microdactylia of both big toes, with hallux valgus. Faradic contractibility diminished. Strong fibrillary spasmodic contractions spontaneously, but more pronounced when touched. Venous stasis, especially in legs.

**CASE LX.**—Reported by Von Kryger, in 1898. Female, aged 4½ years. Family history negative. First symptoms appeared at 2½ years of age—with inflammatory symptoms, a painful bluish-red nodule formed on back a little to the left of twelfth dorsal vertebra. The first tumor decreased greatly and in its place a round osseous protuberance appeared. At various times this process, nearly always accompanied by inflammatory symptoms, spread over back, nape of neck and vertebral column, abdomen and hips. At last face and neck were involved. From the rigid vertebral column emanate long irregular bony ridges; shoulders drawn up, lower arms flexed at right angles, only slightly movable. Hands crossed across the abdomen; legs slightly flexed at hips; right one abducted, immovable. Head inclined toward front and left; face turned somewhat to right; muscles of the cheek and mouth are very hard and mouth can be opened only half an inch. Everywhere in muscles one finds tough cords or bony ridges, some of which are connected with the skeleton, others appear to lie free in the tissues and nearly always follow the course of the fibres, rarely crossing them. From the ribs, the vertebræ and the pelvis real exostoses project vertically to the skin. Microdactylia of both big toes. They appear to have only one phalanx, which stands in valgo position upon the metatarsus. (No X-ray picture.)

**CASE LXI.**—Reported by Walter Stempel, in 1898. Female, aged 7 years (?). Family history neg. First symptoms appeared at three and a half years of age—swelling in sternocleidomastoidei; later in cucullaris and various other muscles of thorax and body. Swellings felt hard at first, got gradually softer and disappeared, as did many other hard swellings in various groups of muscles during the course of three and a half years of observation. Last examination, January, 1898, showed ossification of both cucullares at occiput. Ossification of scaleni. Spine quite stiff. Fixation of lower jaw through hardening of masseters. Microscopical examination of muscle in first stages of hard swelling showed a hypertrophy of the outer fibrillary tissue, which by its rapid growth into the muscular tissue, separating and pulling the muscle fibres, causes an intramuscular hemorrhage, which, according to Stempel, represents the first cause of the swelling which is being followed by the fibrous tissue growth and later by ossification.

**CASE LXII.**—Reported by A. Roth, in 1898. Female, age (?). Family history neg. First symptoms appeared between 1 year and 9 months and 2 years of age—swelling in left side of middle of back. Another swelling at the left side of the neck followed closely; both disappeared after inflammatory symptoms. A similar process developed on the right side of the back, followed by swellings of both arms from shoulders to elbows and of various other places, like chest, abdomen and thigh. After a recedence of the inflammatory symptoms the afflicted parts showed hard exostoses-like masses. Arms grew stiff and lately the face became swollen. Patient perfectly stiff, as if in tetanic rigidity. Two small exostoses, size of peas, above left ear. Maxillary joints ankylosed. Mouth can be opened only ½ cm. The entire cervical muscular group forms one hard mass. The upper arms are bound together by a hard bony ridge in the anterior and posterior height of the axillary folds, comprising latiss. dorsi and pectorales major. Both scapulæ are fixed. Superior



## MYOSITIS OSSIFICANS PROGRESSIVA

and inferior scapularis of osseous hardness. In both upper and lower arm muscles various ossifications and enclosures of bone. Muscles of hands free, narrow strip of bone in musc. obliq. abdom. ext. On both sides, at origin of sartorius, ossification. Microdactylia of both big toes. Valgus position; only one phalanx reaching to first interphalangeal joint of second toe. Microscopical examination of a piece of new-formed osseous tissue shows the change of connective tissue to fibrous, cartilaginous and bony tissue. He believes in passive and active participation of periosteum, as he found hardly any bony pieces free in the muscular substance; also in a congenital diathesis brought into action by traumatism.

CASE LXIII.—Reported by Mr. Jacoby, in 1898. Male, aged 27 years. Family history neg. First symptoms appeared at 19 years of age—pains in ankle-joints and legs. Four years later pains occurred in hips and neck, and only two and a half years ago induration and ossification in the neck, involving all the contour of the neck. Another ossified mass between pelvis and lower edge of arch of ribs. Slight hardness in masseters, but patient can still open mouth well. July 14th: diagnosis confirmed by X-ray pictures characterized it as a bone-muscle disease, which leads to the formation of exostoses and direct ossification of the muscular connective tissue. No mention of congenital abnormalities.

CASE LXIV.—Reported by A. Salomoni, in 1898. Male, aged 12 years. Sound, healthy parents. First symptoms since birth—deformities in neck and arms. Gradual and steady progression. At the time of first observation, in 1897, deformities had greatly progressed. They occupied the entire neck and the two upper limbs in a very characteristic manner. A personal letter from Piacenza, Italy, where Salomoni is now head of a military hospital, explains that on account of being so taken up with his present duties he is unable to go further into the history of this case, and merely gives me what data he remembers. He says: "I extirpated from the neck and from the arm two pieces of the muscles where ossification had gone on. They were histologically demonstrated to be derived from the fibro-connective tissue and from the new-formed bone near the periosteum. The little patient underwent various pharmaceutical treatments, more for the moral effect than for any other purpose, and died at the age of 14 without my being able to continue the observation of his case." This case was reported in the record of the congress of the Italian Surgical Society of Turin, 1898. Salomoni's letter differs from the above-named report and that of the Italian Pathological Society in 1898, which reads: "A girl, 7 years; when 2 years old ossif. of l. sternocleido noticed; later r. side; then gradual swelling and ossif. of other muscles, sometimes with fever. Microdact. of thumbs and big toes."

CASE LXV.—Reported by Hendrick Burgerhout, in 1898. Male, aged 40 years. Family history neg. First symptoms appeared at birth—left shoulder-blade and left shoulder-joint stiff. During schooling years hip- and knee-joints became stiff. Later, after twentieth year, both elbow and wrist-joints stiffened. Ten years ago both maxillary articulations became stiffened so that he could not open mouth. Sits nearly immovable; head bent forward upon chest. Lower jaws very slightly movable. Distinct movement of temporales and masseters. Sternocleido and cucullaris feel hardened, but not osseous. Arms stand in strong adduction; scapulae fixed; at lower outer angle not separable from the stone-hard mass which goes in the direction of teres majores and latiss. dorsi. The long muscles of the neck are connected from neck to os sacrum by irregular ridges of bone. Left arm, shoulder and elbow stiffened; left thigh flexed in hip-joint; left knee-joint and ankle-joint immovable. Large exostoses above patella in location of vast. externus. Right leg articulations resemble left side, but are freer. On inside of femur in place of adduct. hard exostoses extending from pelvis to insertion of adductor magnus. Microdactylia of thumbs and big toes due to smallness of metacarpal and metatarsal bones. Very exact examination of electric irritability of muscles and their nerves; both normal. For very thorough metabolic research work and conclusions of this case see text.

## JULIUS ROSENSTIRN

**CASE LXVI.**—Reported by Robert Jones, in 1899. Male, aged 16 years. Family history neg. Fell and injured his back.(?) First symptoms appeared at 13 years of age—growths on back started one year after his fall. Subsequent course of disease unknown. Growths on inner aspect of right jaw; small lump below right olecranon. Hard mass attached to upper two-thirds of femur; thickening at insertion of right ligamentum patellæ and at each tarsometatarsal joint. Over spinous processes a continuous line of hard cartilaginous or osseous material, extending from level of fifth dorsal to fourth lumbar spine. Strips projected from the upper and lower ends of this mass two and three inches long. They were movable in the surrounding tissues. No deformities mentioned.

**CASE LXVII.**—Reported by Morian, in 1899. Male, aged 4½ years. Family history neg. Fell twice down a flight of fourteen steps. First symptoms appeared at 2½ years of age—soon after second fall swellings in various muscular groups. Fell again after commencement of disease and struck on a stone with his neck. Ossification in right frontalis muscle, in both sternocleid., in the group of muscles from sternum to hyoid and from there to mandibula, in both pectorales major and deltoids, in both sacrolumbales and in both bicipites; in both cucullares and right altissimi dorsi. Both big toes show microdactylia.

**CASE LXVIII.**—Reported by Lyder Nicolaysen, in 1899. Female, aged 4½ years. Family history neg. First symptoms appeared at 2 years of age—stiffness of shoulder, neck and back. Subsequent course of disease unknown. Height 99 cm. Circumference of chest 45 cm. Posture: head bent forward; nape of neck, back and shoulder muscles completely ossified. In both axillary fossæ anterior and posterior folds are hard; greater part of pectoral. maj. ossified. Both scapulæ fixed to thorax. Trapezius bone-hard. Several nodular exostoses on back. Arms stiff and rigid. Hardened parts in musculature of upper arms. Excursion angles of both forearms about 45 degrees. Microdactylia of both thumbs and big toes.

**CASE LXIX.**—Reported by George Wilkinson, in 1900. Male, aged 13 years. Family history neg. First symptoms appeared at 2½ years—swelling in right side of back. Swelling in back subsided. Later isolated hard lumps appeared on back, remaining and spreading. Later stiffness in back. Lower jaw fixed, mouth can only be opened one-fourth inch, due to hard temporal fascia. Bony bars in right occipital bone. Thin plate of bone in occipital tendons and left trapezius, and hardening in right. Hard nodules in both sternocleidii and scaleni muscles. Big bony mass extending from left to right scapula. Two large hard masses in right lat., shoulders raised, scapulæ fixed. Nodule in left pectoral. maj.; two small ones on both sixth ribs. Respiration wholly diaphragmatic; shoulder movements, especially rotation, limited. On each femur large irregular mass of bone fixed to the upper end near great trochanter. A spike of bone extends on each side of gluteus maximus near its sacral origin. Another one down along outer side in tendon of fascia lata to below middle of thigh. Hard nodule in right rectus femor. Sharp nodule of bone projects below each tuberosity ischii. Angular bony nodule on posterior border of right tibia, three inches above int. malleolus. Movements of hips limited. Trunk bent somewhat forward, can sit only on corner of chair. Both thumbs microdactylic. Their metacarpals and phalanges are shorter than those of other digits and interphalangeal joints stiff. Both big toes microdactylic and with hallux valgus. Their two phalanges very short, their interphalangeal joints synostotic; nodules have formed without pain. Some masses that have appeared during the nine months of observation have disappeared again.

**CASE LXX.**—Reported by Morley Fletcher, in 1900. Male, aged 9 years. Family history neg. First symptoms appeared at 7 years of age—location (?). Subsequent course of disease unknown. Numerous exostoses on bones of head, one on the hand and one on each tibia. Thickening of bridge of nose. Both big toes small and terminal phalangeal joints ankylosed. Interesting association of numerous exostoses with

## MYOSITIS OSSIFICANS PROGRESSIVA

multiple neuro-fibromata; looks upon it as abnormal condition of mesoblast from which the mesoblastic structures were formed and as related to the condition of multiple exostoses and multiple neuro-fibromata.

CASE LXXI.—Reported by Theodore Schwickerath, in 1901. Female, aged 14 years. Family history neg. First symptoms appeared at 9 years of age—violent toothache. Two molars were extracted, whole left side of face swelled greatly after extraction of teeth and became permanently stiffened. Patient's jaws became so stiff that she could not open her mouth sufficiently for mastication. A piece of an osseous ridge 1 cm. broad and  $\frac{1}{2}$  cm. thick was removed from the left masseter to increase the possible excursion of the lower jaw. After the operation mouth could be opened 3 cm., but later it returned to almost its pre-operative status. Patient holds herself bent forward. Scar on left masseter where excision was made. Near upper insertion of left masseter a firm nodule, size of cherry pit; in its lower part an osseous ridge  $1\frac{1}{2}$  to 2 cm. broad. Lower jaw can only be opened 2 mm. Lateral movements entirely inhibited. Left clavicle enormously thickened. Left sternocleido a thick cord, shows osseous ridges in sternal and clavicular portion of the pectoral. maj., is as hard as bone, running toward axilla and ending at spine of tuberosity maj. In the middle of right scapula spine is an osseous nodule size of a walnut. Back scoliotic to left and shows partly flat, partly osseous protuberances. On both sides of vertebral column osseous plates; in latiss. dorsi and teres osseous nodules extending right down to region of sacrolumbalis. Right arm: very few excursions possible; adduction, abduction and rotation impossible; in the axilla a hard nodule. Left arm nearly normal; right thigh exostotic thickenings. Microdactylia of both big toes. No X-ray picture.

CASE LXXII.—Reported by Vaughan and Burton Flanning, in 1901. Male, aged 33 years. Father had same disease, dating from a fall in his fifteenth year on his right arm, where it began. The disease had steadily progressed, but had not reached the same degree as with his parent, when he died at the age of 33 from an accident. He had congenital deformity of both thumbs, there being no joint beyond metacarpal ones. Feet were not observed. First symptoms appeared at 8 years of age—left shoulder gradually became stiff without any previous injury or pain. At 12 years right knee began to stiffen and gradually became ankylosed. Following this came stiffness of left hip, sides of chest and lower part of back. At 26 years right arm from shoulder downward became swollen, red and tender. This disappeared, but left arm is fixed extended in shoulder and elbow. Wrist remained free. Two years later stiffening of right hip was noticed. During winter of 1898 difficulty in opening mouth began; passed off during summer, but returned worse the following winter. The following summer got slightly better, but had gradually increased since. Both erector spinæ nearly completely replaced by bone, preventing any movement of that portion of the spine covered by them. Deep muscles of back of neck similarly affected, only possible movement of head is slight rotation and flexion. Bony plates between several ribs; on each side and along ant. border of l. quadrat. lumb. was hard band fixing twelfth rib to crest of ilium. Movement of chest almost prevented by these growths except over first two ribs. The distal halves of both teres maj. and pect. maj. were bony. Close over the right fossa olecrani a bony mass, the size of a walnut, involved the whole thickness of the triceps. A similar growth over the upper ends of the ulnæ and radii. Both extens. quadriceps were almost replaced by bone; osseous growths round head of right fibula and enlargement of both int. malleoli. Both big toes had hallux valgus, with shortening and broadening of phalanges, which were fused together. No X-ray.

CASE LXXIII.—Reported by Wilhelm Rager, in 1901. Female, aged 14 years. Family history neg. First symptoms appeared at 2 years of age—swelling over os frontal. After that many painful inflammatory swellings in various parts of the body, leaving osseous hardenings. Mouth can only be opened  $1\frac{1}{2}$  cm. Both shoulder-

## JULIUS ROSENSTIRN

joints and right elbow-joint ankylotic. Ossification in both masseters, right sternocleido and platysma, both deltoids, pectoral. maj. and latiss. dorsi, quadriceps femoris, right soleus and insertions of both gastrocnemii and solei. Similar ossifications are distributed all over back of neck and the back proper down to lumbar vertebrae. Both thumbs and big toes are deformed, only half as long as normal. In the thumbs, due to two shortened and synostotically united phalanges; in the toes to stunted metatarsal bones.

CASE LXXIV.—Reported by Christopher Graham, in 1901. Female, aged 6 years. Family history neg. First symptoms appeared at 4 years of age—small lump between shoulders. Gradual but steady progression. Rarely any pain except during last three or four months. Ligamentum nuchae solid throughout. Both pectorales and sternocleidi are more or less solidly ossified. Right biceps affected in its entire course; the left only in its upper part. Right trapezius is completely changed into bony mass; the left less so. Both latiss. dorsi are ossified. The deeper trunk muscles seem to be also similarly affected. Right external oblique ossified along the line of the linea semilunaris, below and externally from Poupart's ligament, a hardness and nodules can be felt. No microdactylia mentioned. Upon my inquiry, Doctor Graham kindly answered that he had no recollection of having examined the feet, the boy having been seen in the policlinical department only.

CASE LXXV.—Reported by H. D. Rolleston, in 1901. Male, aged 8 years. Subsequent course of disease unknown. Ossification in both sternomastoids and posterior scaleni muscles and in the scapular attachments of the rhomboids. Bony plates in lower parts of latiss. dorsi. Hard masses in region of erectores spinæ over lumbar spine. Both biceps and brachialis ant. muscles extensively ossified. Both recti abd. are affected. Exostoses on both tibiae near insertion of sartorius muscle and on both frontal bones. Microdactylia of both thumbs and toes, due to dwarfing of metacarpal bones. Commencing ankyloses of interphalangeal joint. Both hallux valgus, with exostoses. Exostoses on first phalanx of right middle finger. (Same peculiarity in Doctor Herringham's case, No. 56.)

CASE LXXVI.—Reported by George Carpenter and Walter Edmunds, in 1901, and Cyril Nitch, in 1908. Female, aged 4 years. Family history neg. First symptoms appeared at 3½ years of age—two weeks after both tonsils were removed a hard and tender swelling appeared on right side of neck. The first swelling subsided after a couple of weeks. Two weeks later a swelling appeared on left side, which also disappeared again. A short time afterward the mother noticed a hard mass on right side of neck, and a few months later similar bumps in left pectoral, scapular and lumbar region. *Condition in 1901:* Spicule of bone in left sternocleido. The neck muscles of same side infiltrated and hard. Below chin bony infiltration size of pea in geniohyoid muscle. Plates of bone can be felt in right sternohyoid, right coracobrachialis, left pectoralis major and erectores spinæ. February, 1905: back and neck quite rigid; movements of shoulders very limited. The early pea-like prominence of bone in geniohyoid has now become a long spinous process. Osteoid tissue in form of plaques, bosses and spicules can be felt in both erectores spinæ, latiss. dorsi, trapezii and pectorales, right rhomboideus major and minor, the sternomastoids, right vastus externus and in popliteal space. Microdactylia of both big toes. 1901: excision from a muscle that showed gray infiltration revealed under microscope fibrocellular tissue infiltration; no micro-organisms.

CASE LXXVII.—Reported by Menard and Tillaye, in 1902, and Comby and Davé, in 1904. Female, aged 5½ years. Family history neg. First symptoms appeared at 17 months of age—swelling (where?). Swelling always preceded hardenings and ossifications (where?). Osseous hardenings in post. cerv. regions and down the back to right axilla, extending toward thorax and to the inner border of humerus and also to the dorsalis maj. On the left side similar changes in the trapezius. Two and a half years later: slow, but steady development of new osseous hardenings.



## MYOSITIS OSSIFICANS PROGRESSIVA

Stalactite formations in axilla, reaching down along humerus to elbow. Head, arms and back stiff, and movements extremely limited. The thumbs and little fingers of both hands as well as the two big toes are undersized. (Microdactylia.) Woodcuts of hands in later observation show microdactylia of thumbs depends on shortness of metacarpal bones. No X-ray in either communication.

CASE LXXVIII.—Reported by Fabio Rialta, in 1902. Female, aged 16 years. Family history neg. Father suffered for thirty years from arthritis of the left hand. Vaccination (?). First symptoms appeared at 2 years. After vaccination swellings appeared on head, from size of pigeon's to hen's egg. The entire left arm became swollen, then subsided. The same occurred then on right arm. Later both arms contracted, with flexion of forearm and adduction of upper arm and inability to raise them. A gradual, continual increase of all these symptoms. The neck swelled and remained stiff. After swelling had subsided some hard indolent nodules developed over the dorsal spine of the scapula the size of those on the head. From the superior dorsal region these formations descended, increasing in number every spring for about twelve years until two years ago, when they stopped. Height 138 cm. Head flexed rigidly toward right and forward; neither active nor passive rotation, extension or flexion of head possible. Vertebral column equally rigid; muscles of neck atrophic; sternocleido contracted and hard. The posterior cervical ligament ossified, with osseous plate; another one runs from seventh cervical downward; ossification of left levator scapulae and cucullaris. The tendon of the pectoralis major is ossified to its insertion. Arms crossed over chest; forearms in exaggerated flexion; osseous plates in biceps, the caput brevis completely enveloped with an osseous growth the size of palm of hand. The anterior wall of axilla also ossified and posteriorly is an ossification extending on both sides from dorsal. maj. to scapular angle and to vertebral column. R. biceps has ossification similar to but less pronounced than left. Processi spin. below seventh dorsal are hidden by ossified masses. Column is slightly scoliotic and absolutely rigid. Respiration completely abdominal, slightly thoracic at base. External genitals normal in size, but hairless. Microdactylia of both big toes. Shortness of first metatarsal bone and hallux valgus. Hemidrosis facialis (sinistra).

CASE LXXIX.—Reported by M. Ferraton, in 1903. Male, aged 18 years. Family history neg. First symptoms appeared at 3 years of age—previous to first swelling in scapular region a three months' period of pain, sleeplessness and loss of appetite. After swelling subsided ossification set in. Ossification of right masseter; left more atrophied. Right sternocleido hard; the greater part seems to be ossified. Pect. maj. and deltoids contracted and atrophied. On the right humerus anteriorly two round exostoses, size of hazelnut, firm upon the bone; on the left side similar outgrowth. Another exostosis on the pelvis on crista iliac. post. to its edge, close to ossified insertion of dorsalis maj. Several large ossifications on the inner side of the right thigh, under middle and large adductors. Right foot: second toe much larger than the others, microdactylia of big toe; on left foot a synovial bursa on first phalanx of big toe. Hallux valgus. (No X-ray.) Operation on masseter muscle; exsection of small piece of muscle. Patient can open his mouth.

CASE LXXX.—Reported by Julius Michelson, in 1904. Female, aged 18 years. Family history neg. First symptoms appeared at 7 years of age—both thumbs over both flexor. brev. hot and inflamed. Later thumbs grew stiff and nearly immovable. Kyphosis and scoliosis at cervical and dorsal spine. Cervical spine stiff, only minimal movements possible in rotation, extension and flexion. Same conditions prevail in dorsal and lumbar portions. Muscles of neck hard. (X-ray shows no ossification.) Pars clavicularis of left pectoralis maj. shows bony deposit extending over the shoulder-joint and into the axilla; this mass can be moved to and fro. A similar mass is on the right side. Both thumbs are ankylotic between first phalanx and metacarpus. The little fingers are shortened. (Second and third phalanges

# JULIUS ROSENSTIRN

are shortened.) Both big toes are 2 cm. shorter than normal and their two phalanges in firm osseous union. The little toes also are shortened and their second and third phalanges ankylotic.

CASE LXXXI.—Reported by Clito Salvetti, in 1904. Female, aged 4½ years. Family history neg. First symptoms appeared at 10 to 12 months of age—swelling observed in the left cervical region. This swelling disappeared, but was followed by two elastic swellings on the occiput, which persisted until now. Neck stiff. Hard infiltrations of muscles back of both supra- and infra-spinosi, and tumor-like indurations size of hen's eggs. Left pectorals like an inflexible plate, preventing the shoulder movements entirely and those of the forearm partially. The left Mohrenheim fossa absent. Neither fingers nor toes show microdactylia. (Specially mentioned.)

CASE LXXXII.—Reported by A. P. Beddard, in 1905. Male, aged 37 years. Family history neg. First symptoms appeared at 7 years of age—bony growths began to develop in muscles. Subsequent course of disease unknown. Bony growths can be felt in innumerable parts of his muscular system. Some of them are movable within the muscles; the majority are fixed, having developed in tendons and insertions of muscles. Ankylosis of joints has developed to such an extent that patient is entirely helpless and absolutely bed-ridden. No mention of microdactylia.

CASE LXXXIII.—Reported by A. Gaster, in 1905. Male, age (?). Grandfather. father and three sons were afflicted with same disease. Subsequent course of disease unknown. Doctor Gaster states in the discussion of Doctor Beddard's case (presented by Doctor Russel) that he knows a family in which the father and grandfather had myositis ossificans progressiva. The three sons suffer from the same disease. Mother and two daughters are free from it; two sons have two baby daughters without a trace of the disease.

CASE LXXXIV.—Reported by Nové Jossierand and René Horand, in 1905 and 1912. Female, aged 7½ years. Family history neg. First symptoms appeared at about 6½ years of age. Subsequent course of disease unknown. On both sides of scapulæ a tumor size of mandarin, the right a little larger than the left. Osseous indurations on the trapezius and in the upper part of right sternocleido. In lumbar region an osseous plaque near the iliac crest. In right and left pectorales major and minor are ossifications. Both big toes are shortened and show hallux valgus. Last phalanx of each little finger is noticeably turned outward. In 1912, on account of progression of disease, patient was induced to submit to X-ray treatments. Had twenty-six treatments, all below five Holzkecht's units. Effect surprising; patient straightened out, can again walk with youthful agility up and down stairs, sit and lie down unaided, and is no more imprisoned in her shell. As to duration of this improvement, author promises watchful waiting.

CASE LXXXV.—Reported by S. Biegel, in 1906. Male, aged 7 years. Family history neg. Born in occipital presentation; was delivered with forceps; large hæmatoma over occiput (?) Head at first drawn out lengthwise, but after few days normal shape restored. First symptoms appeared at 3 months of age—parents observed apparent displacement of parietal and other bones of skull, and a little later swellings on head size of pea to a marble. These swellings disappeared after a few weeks. Previous to appearance of swellings on top of head and on neck there was always stiffness vertebral column and cyanosis of head and of extremities, which again disappeared as soon as swellings were fully developed. This lasted with intervals to his third year. From third to sixth year he was quite well, although a slight knock or a slight fall always produced hard nodules, which disappeared again after a few days. About one and a half years ago he fell upon his head. From this time on he grew stiff. Can now hardly move. At first his neck grew stiff and he could not turn his head. Later maxillary muscles stiffened; mouth could not be opened more than enough to admit flat spoon. This condition improved so that he

## MYOSITIS OSSIFICANS PROGRESSIVA

could open his mouth again, but stiffness developed in the muscles of his mouth. *September, 1905*: a stone-hard thickening of both sternocleidæ; *December*, stiffening of upper arm and thorax muscles of both sides, in left side osseous ridge remained. Head bent to left side and forward; breast and abdomen bent backward and to the right. Both sternocleidæ and platysmæ feel like hard plaques. From left side of axilla a bony ridge goes over pectoralis major, serratus ant. maj., obliquus ext. abd. Both cucullaris are hard, the edge of the scapulæ strongly projecting. The right arm hangs along the side of the trunk and the hand rests on the thigh; the left is abducted in shoulder-joint and flexed in elbow so that the hand rests nearer to Poupart's ligament. Both are limited in their movements, the left more than the right. All the hand and finger-joints are well movable. Both legs are flexed in hip- and knee-joints. Hip-joints are stiff, but below these joints limbs are well movable. Microdactylia of both thumbs and big toes.

CASE LXXXVI.—Reported by E. J. Maxwell, in 1907. Male, aged 10 years. Family history neg. First symptoms appeared at 5 years of age—hardness of spine muscles. Gradually increasing ossification of muscles of spine near the sacrum and back, spreading upward. Spine and head absolutely rigid; growths of bones branched out from spine to scapula. Breathing mainly abdominal. Only liquid could be swallowed; condition of masseters and jaws not given. Bone could be felt on right side of larynx. No mention of microdactylia. No X-ray picture.

CASE LXXXVII.—Reported by A. E. Garrod, in 1907. Male, aged 21 months (weight  $23\frac{1}{2}$  pounds). Family history neg. First symptoms appeared at 3 or 4 months of age—lumps appeared on head. Child healthy at birth, but soon began to waste. Improved to normal condition, however, when nursed by colored woman. The lumps disappeared completely three or four months later. At 16 months fresh swellings appeared upon back, increasing in size for some time, then disappeared again, while fresh swellings had appeared in new locations. Swellings upon back, two in front of chest in outer parts of pectoral muscles; one on the head over occipital bone. Swellings disappeared and new ones came during the time of observation, *May 29, 1906, to July 20, 1906*. Patient left without any bone formation having occurred in any of the swellings during this first period of observation; no constitutional disturbance or particular pain seemed to accompany the appearance of the swellings. One year later reported: right biceps is contracted and feels stony hard; stiff elbow and right shoulder-joint. A lump size of mandarin orange over infraspinatus, of ivory hardness. Other lumps forming. Health seems to be perfect. Microdactylia of both big toes in valgus position. Over the inner aspect of the head of each first metatarsal bone was a small linear scar, suggesting that an extra digit had been removed.

CASE LXXXVIII.—Reported by Paul Krause and Max Trappe, in 1907. Female, aged  $16\frac{1}{2}$  years. Family history neg. Severe cold (?). First symptoms appeared at  $12\frac{1}{2}$  years of age—tired feeling in arms and legs, and back began to feel stiff. Pains in various parts of her body; knees sensitive to pressure; stiffness of legs increased, arms became bent and stiff. About the winter of 1905-06 appeared a swelling in lower sacral region, which disturbed the patient when lying down. A bone-hard nodule was removed from right ant. axillary wall; since then she can move right arm better than left. A swelling of the feet appears now from time to time, but soon disappears again. The swellings when softened evacuated an emulsion of amorphous calcium salts. Later the skin became sclerotic, dry and immovable over its underlying tissues. Patient 155 cm. tall; weight 34.5 kil. Very strongly developed arci zygomatici and large pupillary distance (65 mm.). Slight left scoliosis in lower dorsal and lumbar portion. Pect. tendons are hard as board, contain several nodules hard as cartilage. Scapulæ show over spinæ several small tough nodules; over right acromion a hard tumor size of a cherry pit. In upper and lower parts of both biceps are several small nodular imbeddings. In right cubital fossa a

# JULIUS ROSENSTIRN

collection of nodules connected with the lacert. fibrosus, continuing to the forearm; on the left only one small nodule. *Hands show nothing abnormal.* Over right sacroiliac joint nodule of bony (?) consistency, size of millet grain, and to the left of the spinous process of fourth and fifth lumb. vert. a soft swelling, size of a silver dollar, sensitive to touch. On both sides of os coccyx three globular swellings about  $2\frac{1}{2}$  cm. In the gluteal muscles small nodules size of cherry pits. The adductors at their origin, at os pubis, as hard as board. At the inner epicondylus of the left thigh two nodules of cherry-pit size adherent to skin and movable with it over the underlying tissue. Toes all well developed. The microscopical examination of the excised axillary nodule showed only a sort of fibrous hyperplasia and infiltration of the muscular tissue. The late beginning ( $12\frac{1}{2}$  years), after a cold, the absence of new pathological cartilage- or bone-formation or even of calcification in the X-ray pictures or in the excised nodule, the softening, liquefaction and discharge of thick, mucous emulsions, the dryness, sclerosis and immovability of the skin, the absence of microdactylia—all these features do not fit into the picture of *myositis ossificans progressiva*, but stamp the case as belonging to *myositis fibrosa*. Since writing I found that in a later article the authors\* abandoned a diagnosis of this case as *myositis ossif. progressiva*.

CASE LXXXIX.—Reported by Roberto Solè, in 1908. Female, aged 7 years. Family history neg. First symptoms appeared at 4 years of age—parents detected two cords in abdominal wall extending from thorax to pubes, and according to description of location were the recti muscles. They felt hard to the touch. These two cords persisted in their hardness till child was 4 years old, when they gradually disappeared and abdomen grew normal. Often fell in the first years of her life and at  $2\frac{1}{2}$  years had severe fall, after which and since numerous hard tumors appeared, mostly on neck and thorax. Suffered severe pains at 3 years. These disappeared at 4 years, but tumors remained and increased in number and size. Head bent forward and fixed firmly. In the ant. region of the neck two stiff hard cords in the location and direction of the sternohyoids and mylohyoids, like rosaries on account of their interspersed osseous infiltrations along their course. A similar formation exists posteriorly on both sides of the cervical vertebral column, from the superior part of the thorax to the base of the occiput. Thorax in kyphosis position, but not angular. It shows numerous hard osseous tumors over the ribs, some intimately adherent to them; others simply on their borders. Both pectorales major and latiss. dorsi are ossified, keeping the arms in their rigid posture in the shoulder-joints. Some few nodules of ossified tissue in triceps brachii. No mention of microdactylia, but in one of the photos of this case the presence of microdactylia of the big toes can be plainly seen.

CASE XC.—Reported by Warren Walker, in 1908. Female, aged 7 years. Family history neg. First symptom appeared at 6 years of age—stiffness of neck. Later a swelling appeared in the right pectoral muscle and others in different parts of the body. These swellings were painful to the touch. Marked prominence of occipital tendon of right trapezius, muscle very hard and stands out like a cord. The scaleni and sternocleidii also involved, but not so extensively. Head fixed on sternum, no rotation possible. At lower angle of left scapula exostosis one inch high, another one over ninth rib just below the scapula is covered by a mass of indurated muscles. Right scapula similar to left. Exostoses on eleventh and twelfth left ribs and several on left of lumbar spine in substance of erector spinæ. Spinal column rigid. Arms are held off trunk in abduction, cannot be brought to side of trunk. Left humerus only movable with aid of scapula, over shaft a bony mass size of pigeon egg. Motion of right arm also limited. Bony masses in anterior and post. axillary folds prevent motion. Entire absence of thoracic respiratory movement. Breathing abdominal muscles free. Left thigh 1.75 cc. larger than right. Fingers are all

\* Fortschr. auf d. Geb. d. Röntgen Strahlen, bd. 14, H. 3.



## MYOSITIS OSSIFICANS PROGRESSIVA

shorter than normal; little finger particularly so. Hallux valgus and microdactylia of both big toes. The first metatarsal bones short and stubby and interphalangeal joints of big toes ankylosed.

CASE XCI.—Reported by Charles Adair Dighton, in 1908. Male, aged 11 years. Family history neg. First symptoms appeared between 4 and 5 years of age—following successive attacks of measles, bronchitis and whooping cough; complained of general malaise and weakness—most marked in legs; child unable to walk. Subsequently muscles became stiff and hard, lumps formed in them, increasing steadily in size and numbers up to time of observation. Weak and undergrown. Skin very tender to touch. Walks on balls of toes. Lost almost all movements of shoulders and elbows. Both arms show large bony nodules in biceps, triceps, coracobrachialis and anconæus. The biceps are almost completely converted into bone. Left arm shows greater development of osseous masses. Forearm free, but muscles atrophied. In both legs adductors completely ossified. Extensors and flexors less affected. Left leg more marked than right. In the line of fibres of obliquus abd. ext. on either side where they run toward the pubic bone is an osseous plate the size of a man's hand. No mention made of microdactylia. Doctor Dighton kindly sent me his notes of the case, but no mention was made therein of presence or absence of microdactylia.

CASE XCII.—Reported by Charles F. Painter and John D. Clarke. Male, aged 25 years. Family history neg. First symptom appeared at 6 years of age—torticollis; a symptom pronounced as hereditary in his family. Numerous nodules developed all over the body in various parts and different articulations of spine and limbs became ankylosed. The right hip was mobilized operatively by removal of bone so that the joint could be freely moved after operation, but bony masses soon formed again. An open incision tenotomy of internal and external hamstrings was equally unsuccessful. A hard mass on right side of chest. A mass the size of a lemon situated under the left glenoid cavity. Motion of elbow limited. Numerous nodes can be felt over arms, wrists and fingers near joints. On both sides of the spine over the fourth or fifth ribs are pronounced nodes, and similar ones occupy the right side of spine opposite sixth to eighth ribs. Slight motion in atlanto-axoidean articulation, restricted by nodes. No thoracic respiratory motion. Dorsal and lumbar spine completely ankylosed. Left hip flexed about 40 degrees and adducted, with practically no motion. Nodes on left tibia on the upper epiphysis, limiting both extension and flexion of knee. Left ankle ankylosed, with nodes on dorsum and planta of metatarsus and phalanges. The right quadriceps muscle and the hamstring tendons undergoing ossification along their entire length. Nodes on tibia similar to left side. Right foot similar to left. The second toe of the left and second and third toes of the right foot are mentioned as being enlarged. (The X-ray picture of the left foot shows microdactylia of big toe through smallness of metatarsal bone.) This and a similar condition in the right foot may explain the elongation (?) of second and third toes.

CASE XCIII.—Reported by G. Rizzuto. Female, aged 8 years. First symptoms appeared at 4 years of age—in greater part of muscles of neck and nape of neck. Later attacked sacrolumbar regions. Osseous hardenings in neck, lumbar region, scapula, thorax and arm. Later affected the roots of right last ribs over the corresponding iliopsoas. Made hæmatological observations. (Only this brief, incomplete history as an account of the demonstration in the official report of the congress.)

CASE XCIV.—Reported by H. B. Allen, in 1909. Male, aged 27 years. Family history neg. First symptoms appeared in early youth (?). Subsequent course of disease unknown. Right temporal muscle partly ossified. Plates of bone along main tendon of erector spinæ in dorsolumbar region and spreading in direction of supraspinous ligaments, serrati post. inferior, and from lower ribs to inferior angle of scapulæ, uniting them both and sending off superficial process into ossified liga-

mentum nuchæ. Left arm: thickening of bone at inner bicipital ridge, at posterior edge of ulna and around wrist. Right arm: thick buttress of bone in pectoralis major from clavicle to outer bicipital ridge. Beginning ossification in capsule of shoulder. Osseous plates along shaft of humerus and process from upper part of olecranon. Osseous hypertrophies at upper and lower ends of forearm. Left leg: thick buttress bone from ischium to femur, in line with quadrat. fem. Some osseous hypertrophies near insertion of gluteus maximus and upper part of adductor longus; osseous growth with knee-joint, causing ankylosis, also binding the heads of tibia and fibula; similar growth at lower ends of bones. Right leg: bony ankylosis of hip-joint, with outgrowths from trochanter reaching tuberos. ischii, and others from both trochanters to front of os pubis. Lower ends of bone similar condition as left. Only photographs and skeleton available. Microdactylia of both thumbs and big toes and ankylosis between some carpal and interphalangeal bones; ankylosed and deformed second and third toe-phalanges.

CASE XCV.—Reported by L. R. Krever, in 1910. Female, aged 28 years. Family history neg. First symptoms appeared in twentieth year—very painful swellings on left shoulder, with light chilblains. Subsequent course of disease unknown. Ossification of pectorales, deltoid, supra- and infra-spinati muscles, trapezii, latiss. dorsi, the lumbar muscles, fascia lumbodorsalis. No microdactylia mentioned.

CASE XCVI.—Reported by K. F. Person, in 1910. Male, aged 18 years. Family history neg. First symptoms appeared at 5 years of age—soft, painful tumors on sides of neck. Tumors disappeared later, only to reappear in back of neck. At 13 years of age ossification of posterior muscles of neck, strongly involving ligam. nuchæ, spinal and lumbar muscles, and erectores of left thigh. Head slightly inclined backward and completely immovable. Spinal column has slight scoliosis, is completely immovable in cervical and dorsal portions. Slightly movable in lumbar portion. Exostoses and hyperostoses on scapula, vertebræ and head of left fibula; sharp atrophy of muscles of back, scapula, pelvis, which have not become ossified. Limited movements of both shoulder-joints, especially right; of both knees, especially left; of both ankle-joints and of toes. Scapulæ and ribs completely immovable; respiration abdominal. Microdactylia of both big toes, with aplasia of phalanges; bilateral hallux valgus and bilateral partial syndactylism of second and third toes.

CASE XCVII.—Reported by G. A. Pirie, in 1910. Male, aged 6 years. Family history neg. First symptoms appeared at 2 years of age—could not turn his head freely; had difficulty in moving it upward. Thickening and induration of ligamentum nuchæ. Hardness gradually increased up and downward, and when child was 3 years old the new tissue felt as hard as bone and had extended and adhered to occiput. This osseous growth was removed, and thereby the absence of spines and laminae of third and fourth cervical vertebræ and defect in the closure of the spinal canal revealed; the spinal cord was exposed. A few months after operation difficulty in raising his arms developed, and examination showed swellings and indurations in latiss. dorsi muscles along both sides of vertebral column. They gradually increased and spread until nearly all the muscles, tendons and ligamentous tissues over back of thorax have become ossified. Osseous formation on back of neck has been formed afresh and is adherent to vertebræ lower down. A similar one is forming on left side. On right side osseous band extends from lower rib to crest of ilium. A few bony nodules at inner sides of both tibiae and slight induration of adjacent muscles. Microdactylia of both thumbs.

CASE XCVIII.—Reported by Alves de Faria, in 1910, and Jorge de Toledo Dods-worth, in 1912. Sex unknown. First symptoms and age of their appearance unknown. Subsequent course of disease unknown. Entire report based on two radiographs. 1. Taken in left profile: osseous changes in superficial muscles of neck, after severe atrophic changes. Osseous bridge from occipital protuberance to dorsal muscles.

## MYOSITIS OSSIFICANS PROGRESSIVA

Between these and vertebral column some indefinite shadows, denoting second stage of invasion. 2. Anterior view of thorax: from seventh left intercostal space running toward humerus, but not reaching it, was a cross-formed osseous process. On right side a similar bridge joins the bone. From sixth rib a bony elongation runs to the outside and ends about middle of preceding one. The two are connected by a third one. Humerus thickened in upper part; numerous osseous nodules on back. Microdactylia not mentioned. No X-ray picture of hands or feet.

CASE XCIX.—Reported by P. J. Stoyanoff, in 1912. Male, aged 25 years. Family history neg. First symptoms appeared at 10 years of age—when patient had variola. Subsequent course of disease unknown. Signs of former variola all over body. Insertion genioglossus muscles ossified. Neck rigid and moves with great difficulty. Trapezius ossified and joined to scapulae, which stands out wing-like. Scapulae ossified. The clavicles are bent, but muscles of the supra- and infra-spinous fossae being ossified. Multiple exostoses; axillae ossified. Large portion of pectorales ossified. Insertion of deltoids ossified, as also that of left triceps humeri. Parts of biceps and coracobrachialis ossified. Left elbow ankylosed at 180 degrees. Movable 15 to 20 degrees. Spine ossified; vertebrae immovable. Scoliosis toward left 150-160 degrees, in cervical region lordosis almost 90 degrees. Musculature of back ossified and united to scapulae. Gluteal insertion ossified. Left trochanter major has exostoses 7 cm. in diameter. Adductores femoris ossified and aponeurosis hard. Tensores fasciae hard. Vastus intern. on condylus intern. ossified. Right knee almost ankylosed at 90 degrees. Exostoses in right popliteal region and in pes anserinus 4 cm. long. Triceps surae hard as though ossified. No microdactylia mentioned.

CASE C.—Reported by Author R. Elliot, in 1911. Female, aged 17 years. Family history neg. First symptoms appeared shortly after second year—lumps appeared on her head and disappeared again; no apparent cause, no injury. In the succeeding three years more nodules formed. At 5 years torticollis appeared and remained for about six months. Later painful swellings on arms and legs interfered greatly with motion. Since that time patient has never been able to abduct her arms or raise them. A valvular heart lesion was then discovered; no previous acute infection or rheumatism. January, 1907, typhoid; July, 1907, stiffness of jaw; teeth could be separated but slightly; hard bony mass fills submaxillary region. Hard circumscribed swellings free from ribs on both sides of thorax. October, 1907, both arms became stiff and partial fibrous ankylosis developed in right elbow-joint. Left shoulder and arm followed. Head bent forward and downward; stiff. Maxillary movements much restricted. Teeth separable only about one inch. Lower jaw displaced to right side. Anterior and posterior neck muscles firmly indurated. Mastoid part of sternocleidomastoid of bony hardness; clavicular origin indurated. Pectoral muscles hard and contracted. Hard nodule on upper border of left scapula. Small exostoses on right eighth and eleventh ribs; also ninth left; also on posterior crest of iliac bone. Body bent forward; rotation of trunk impossible. Spine firmly rigid. On either side of lower dorsal and lumbar spine a broad bony mass, over right inguinal region a firm induration size of a man's palm. Abdominal muscles tender to pressure. Muscles of legs free, but patient states that they feel too short. Both thumbs show bony ankylosis in terminal phalangeal joints. Second joint pliable, but atrophic. Thenar flat and atrophied. Never had voluntary movements of thumbs. They are held flexed on palms (pollex valgus). Microdactylia of both big toes; absence of one phalanx (?). Toes directed outward, lying partly under second toe (hallux valgus). No X-ray of toes. Cause of short-hallux probably erroneous, and shortened metatarsus primus; here the usual explanation—X-ray of hands shows shortened metacarpus primus.

CASE CI.—Reported by Jgn. Peteri and Gust. Singer. Male, aged 4 years. Family history neg. First symptoms appeared at 1½ years of age—swellings on right and left sides of forehead. They disappeared again after a few days. Other

swellings appeared, which grew harder and finally became as hard as bone. 1906: head bent forward and fixed rigidly, only slight lateral motion. A swelling size of a child's fist developed in submental region; during his hospital stay other inflammatory symptoms. With relief of these symptoms a solid mass remained, impeding movement of lower jaw. Ridges of bony substance in temporal and masseter muscles. Muscular part of nape forms a diffuse, solid bony mass with nodulated surface, causing rigid stiffness of neck. Slender bony ridges in both sternocleidii bound to broader ones in deeper cervical muscles. Pectorales major and minor changed to hard osseous plates. The upper arms are firmly united to shoulder-blades and ribs by broad hard bridges, in anterior and posterior axillary folds. Both biceps and brachialis ant. contain broad bony ridges along entire length. While the right one is partially fixed to humerus, the left runs free from bone to tuberosit. ulnæ. Both scap. fixed to back. Musc. of forearm tough and fibrous. Entire vert. column rigid. The processi spinosi form, together with muscles and ligaments, thick, heavy, protuberating masses of bone tissue. Four years later: patient again admitted. Stiffness and immobility of entire upper part of body. Angular conformation of shoulder girdle and various relief-like elevations throughout body had increased, especially those of obliquus intern. Microdactylia of both thumbs and big toes. (Synostosis between short first metatarsal bone and first phalanx.)

CASE CII.—Reported by Felix Bauer, in 1911. Aged 2½ years. Sex not mentioned or alluded to in entire paper. Family history neg. Scarlet fever when 6 months old (?). First symptom noticed was ossification of neck after scarlet fever. Ossification of neck and shoulder progressed and caused decrease of movability of head and arms. Strained, bent-forward posture of head and upper part of body. Upper extremities fixed. Spinal column stiff. Sternocleidii and the deep neck muscles, the shoulder muscles and both bicipites are ossified and intersected with projecting lumps and spurs. They are mostly fixed to the underlying bones; only those of the biceps are free and movable in the muscles. From costal arch in anterior axillary line extends a round partly fibrous and partly osseous ridge size of penholder toward the symphysis. It continues upward toward the fifth rib on both sides. Over the shoulder-blades and at sides of spine several immovable, semiglobular, osseous tumors. Microdactylia of both big toes; in a lesser degree of both thumbs and little fingers.

CASE CIII.—Reported by Otto Jüngling. Male, aged 6 years. Family history neg. First symptoms appeared before end of first year—lumps developed in nape of neck. At first lumps disappeared again without leaving any traces, but after some time they recurred in the same place, remained and grew hard. Gradually this process spread from the neck to the back and arms, and for some time the upper part of the boy's body has been stiff. Head, neck, shoulders and trunk quite stiff. Mouth can only be opened 1¾ cm. In the neck only the vert. prominence can be felt; from it a bony ridge 4 cm. long, thickness of a small finger, starts downward, divides into two and at level of scapula turns up again. At about the ninth vertebrae another ridge starts obliquely to the angle of the left scapula. On the right side only two lumps. The lumbar portion of the spine shows slight scoliosis convexity to right. The sacrospinalis on the left is stone-hard in its entire length. A small bone plate in the height of the fifth lumbar vertebra. The upper arms are fixed to the thorax in an angle of 35 degrees. From the scapula angles hard ridges run to both humeri. In both triceps are hard bony masses and two stalactites in the right elbow head. Both thumbs very small, due to smallness of first metacarpus. The first and second phalanges of second and third fingers very small and ankylotic. Shortness of right first, third and fourth and left first, fourth and fifth metatarsal bones. The left first, fourth and fifth metatarsal bones show only minute epiphysial nuclei (distal) and the phalanges of all the toes are deficient. The first metacarpal metatarsal bones show



## MYOSITIS OSSIFICANS PROGRESSIVA

only proximal, the other second, third and fifth only distal epiphyses. Hypospadias—urethral orifice at scrotal insertion.

CASE (?).—Reported by Riehl, in 1912. Male, age (?). No family history. First symptoms appeared since 6 years of age—febrile attacks of pain in joints, with redness and swelling of skin. Later lime deposits in muscles and subcutaneous tissue. Skin difficult to fold; thickened in places, in others atrophic. Very little fat in subcutaneous tissue. Irregular and indistinct cloudy or striped shadows and very little pronounced ossification in X-ray picture. Author speaks himself of similarity of his description of this case with severe scleroderma. (Not myositis ossif. progress.) No mention of microdactylia.

CASE CIV.—Reported by C. A. Manjapa, in 1912. Male, aged 25 years. Family history neg. Feverish illness at 6 or 7 years of age. First symptoms appeared at 6 or 7 years of age—had fever for nearly six months, and about that time lumps were discovered on back of neck and chest. Grew gradually unable to stand erect or walk freely and became mentally deficient. His disease, on account of lumps, was erroneously diagnosed as leprosy and he was transferred to the leper asylum; later, in September, 1907, on account of his mental condition, to the lunatic asylum. Patient can only sit and stand in a crooked position. Head fixed, with deflection to left side; incomplete lockjaw, due to stiffness of masticating muscles. Neck stiff and almost all voluntary muscles in slight or greater degree of ossification. Trapezius and erectores spinæ present, bony ridges extending from suboccipital to lumbar region and bony tumors at spine and inferior angle of right scapula. Left pectoralis major hard; bony ridges along sternal fibres, connecting with one from their humeral insertion. Right deltoid also shows bony ridges. Right forearm fixed at right angles to arm by bony buttresses. Left forearm fairly movable, but not to full extension. Right supinator longus entirely ossified and bony swellings in flexors and extensors of left forearm. Left thigh has movable bony plates in region of extensor quadriceps, adductor longus and hamstring muscles. Had short fingers and short toes. About eight months prior to his death (July, 1910), from dysentery, patient began to lose flesh and strength. The joints became more firmly fixed and the osseous growths very prominent and distinct.

CASE CV.—Reported by Fritz Magyar, in 1912. Female, aged 3 years and 9 months. Family history neg. First symptoms appeared at 3 years—hindrance in motion of muscles of upper arm and pains on pressure. Pains disappeared, but hindrance remained and muscles grew stone-hard. Head bent forward. Ossification of both bicipites brachii; on back also ossifications in serrated form adhering to underlying tissues. The movements of arms were interfered with by hardening of upper and lower margins of latiss. dorsi posteriorly and pectorales major anteriorly. No mention made of microdactylia. (Brief notes only in *Wien. mediz. Wochenschr.*) To personal letter received no reply.

CASE CVI.—Reported by David Rankin, in 1912. Female; a little negro girl. Subsequent course of disease unknown. Casual observation of author during visit to a hospital in Brazil, where he saw a little black girl suffering from myositis ossificans progressiva, with trapezius, latiss. dorsi and greater portion of both pectorales ossified. No mention made of microdactylia.

CASE CVII.—Reported by Joseph Frattin. Female, aged 14 years. Family history neg. First symptoms appeared at 1½ years of age—painful swelling at nape of neck; disappeared again within twenty days without leaving a trace. At 4 years painful swelling again developed in same place and disappeared again, but neck remained stiff; later back and hip, which likewise showed exceedingly hard tumors. She suffered from epilepsy at an early age. The attacks grew rarer, and two months after leaving hospital disappeared entirely. Head slightly inclined toward right; can be turned, but not freely moved from side to side. Hard nodules on both sides of glabella, some adherent to bone. Muscles on both sides of nape of neck have bony-

## JULIUS ROSENSTIRN

hard nuclei at occipital insertion, the right sternocleido at mastoid and a bony thickening at clavicular. Lower insertion of *scalenii* ossified. Upper margin of *cucullaris* and upper part of left sternocleido ossified. Tendon changed to osseous band. Both arms fixed in adduction. In right biceps and triceps, pectorales, latiss. dorsi, many bony plates; on left side tendons of these muscles ossified; on lower epiphyses of humerus irregular bony mass encircling joint completely. Breathing abdominal. Broad muscles of back completely ossified, left more so than right. *Infraspinatus* and *sacrolumbalis* show osseous plates movable in muscular tissue. Near sacroiliac symphysis are osseous tumors; both hips stiffened; soft parts surrounding coxo-femoral joints show many ossifications. At lower part of *gluteus major* large osseous band and an osteoma on inner side of *crista ilii*. Similar conditions on left leg. Head, slightly inclined toward right, can be turned but not freely moved from side to side. Both big toes show *microdactylia*. Left smaller than right. X-ray picture not quite clear.

**CASE CVIII.**—Reported by S. Goto, in 1912. Male. Family history neg. First symptoms appeared at 1 year and 10 months of age—swelling and hardening in jugular fossa. Later an osseous formation developed in the jugular swelling. A year afterward swellings on occiput and various other parts of the head, which disappeared again. Since January, 1911, parents have noticed stiff posture of body. Weight, 14.525 kils.; height, 93.0 cm. Movements of head very limited. From posterior surface of mandibula comes a hard osseous band to posterior surface of chin. Small tumors at sternal origin of sternocleido and at insertion of trapezius. Both scapulae fixed to thorax and their lower angles are united in one solid mass with surrounding ossified tissues. On both sides of sixth to eighth dorsal vertebrae bony growths size of thumb. Along both sides of spine broad, symmetrical, flat, bony growths 3 cm. broad, united below to *crista ilii*, above to masses at sides of vertebrae. The ant. and post. axillary folds are ossified. Arms only very slightly movable in shoulder-joints, free in elbow and other joints. A string-like band in right side of abdomen and a small, hard, osseous thickening on inner condyles of femur and tibia. Both thumbs and big toes abnormally small, owing to smallness of metacarpal and metatarsal bones. (*Hallux valgus*.) Electrical sensibility; decrease to absence of irritability to faradic or galvanic current in affected muscles. Those apparently free from affection show no disturbance.

**CASE CIX.**—Reported by Rudolph Jacobi. Male, aged 6 years. Family history neg. First symptoms appeared at 3 years of age—hard nodules formed on back. Nodules were rather flat at first, but grew gradually to their present size. For the last five weeks there has been a disturbance of the free motion of his right arm. Movements of head not free; chin cannot be brought to thorax. Scattered over entire back are numerous osseous protuberances of semiglobulous and flat form, averaging pigeon-egg size; also long ridge or beam-like elevations of about 15 cm. length and thickness of thumb diverging from median line to lateral parts of thorax. Nearly all the muscles of the back are changed into a hard osseous mass, encasing the ribs armor-like and inseparably connected with them. Respiration abdominal; thorax shows only minimal excursion. Arms and legs show no change except *exostoses* on both condyli interni tibiae, 2 cm. long. *Microdactylia* of thumbs and big toes. (*Hallux valgus*.)

**CASE CX.**—Reported by S. J. Khaikis, in 1913. Male, aged 4 years. Family history neg. First symptoms appeared when about 3 years of age—old swellings appeared on occiput. Later swellings showed on back and lower extremities (treated by local physicians with *inunctions*); they would subside, then reappear. These tumors began to appear first on the occipital musculature, then on that of the back and upper ribs. The swellings along the ribs were quickly absorbed, but the others hardened and had the consistency of bone. Patient only complained when new swellings appeared. Boy normally developed. Pain when bent over, but head can be bent

## MYOSITIS OSSIFICANS PROGRESSIVA

forcibly in the different directions without pain. Occipital movements interfered with by tubercles on occipital bone about attachment of cucullaris. Similar tubercles on both sides of spine along lower third dorsal and first lumbar vertebræ. Other nodules appear over middle of upper ribs; also in axillæ, interfering with raising of arms. During observation of one month methodical treatment with potassium iodide, baths and fibrolysin. Condition grew worse, redness and swelling to left side of second lumbar vertebræ. Redness disappeared again, but swelling grew osseous. No mention of microdactylia.

CASE CXI.—Reported by Volhynia Medical Soc., 1913. Female (?). Subsequent course of disease unknown. The foregoing case was before his discharge shown in the Volhymia Medical Society. A similar case of a girl was demonstrated there also. Demonstrator not mentioned in report.

CASE CXII.—Reported by Erich Blenkle, in 1914. Male, aged 21 years. Family history neg. Not much known about early history; lost parents very early in life. Subsequent course of disease unknown. Stature of boy 10 to 12 years; height, 137 cm.; panniculus underdeveloped. All the limbs except the right leg and hand stiff; cannot sit down, has to do his work, eat, etc., standing. Impossible to mount stairs. Jaws cannot be opened more than  $\frac{1}{2}$  cm. Teeth (incisors) have been removed for feeding. Masseters hard, with hard osseous nodules imbedded. Head only movable sideways in very slight degree. Spine completely stiffened. Sternocleido and neighboring muscles of neck, entire musculature of back stiff and hard and interspersed with small osseous nodules. Along entire dorsal spine large osseous plates; below tenth and eleventh vertebræ no muscles to be felt; only one continuous osseous plate, extending to crista ossis ilii. Thorax and ribs immovable; breathing entirely abdominal. Pectorales and deltoids stiff and hard. Both arms fixed, left less so. Osseous imbeddings in biceps and triceps and near origin of extensor carpi radialis. Slight volar flexion possible in left wrist. Both hip-joints immovable; hard masses surround both trochanters; knee-joints slightly movable; osseous plates in left adductor. Exostoses of femur; hard mass around left knee muscles of right leg, around hip and knee-joint hard and stiff. Both thumbs small (microdactylia). Third phalanges of fourth and fifth fingers turned toward radial side. No microdactylia in either foot.

CASE CXIII.—Reported by F. Parkes Weber and Alwyn Compton, in 1915. Female, aged  $2\frac{1}{2}$  years. Family history neg. First symptoms appeared at  $7\frac{1}{2}$  months of age (March, 1913)—was shown before the Royal Society of Medicine, with bony projection from left side of neck and thin spicula of bone attached to middle of the back of left clavicle. In March, 1914, various diffuse swellings appeared, involving muscles and superficial fasciæ; skin could be freely moved over them. They disappeared and soon were followed by others in left scapular region and left lower part of thorax. Similar ones appeared also on right side. In May, 1914, a distinct bony formation appeared in left posterior axillary fold, and transient swelling in right pect. maj. In June hard swellings in right biceps and lower part right scapula and corresponding ones on left side. In September and October a bony lump on occipital insertion of trapezius. Very stiff in movements of back and neck, extension grows more and more limited. There also seems to be osseous infiltration in both anterior and posterior axillary folds, limiting abduction of both arms. Microdactylia of both thumbs and big toes; in the thumbs due to smallness of the first metacarpal bones; in the toes to a synostosis and resultant smallness of phalangeal bones. (Hallux valgus.) A small piece of right latiss. dorsi examined microscopically showed invasion of muscle by newly formed fibrocellular connective tissue.

CASE CXIV.—Reported by Angel M. Centeno. Male, aged  $8\frac{1}{2}$  years. Family history neg. At  $3\frac{1}{2}$  years phlegmonous (?) inflammation of left sternocleido. First symptoms appeared at 6 years of age—entered Children's Hospital. Smooth, hard, painless tumors in region of right scapula. (Caught measles in hospital, but recovered

## JULIUS ROSENSTIRN

without complications.) When seven months in hospital first operation was performed on sternocleidomastoid tumors. Result not known to parents. Later new, round, hard, painless tumors of various sizes appeared over the entire region of the dorsalis major, the trapezius and the costal walls. Shortly after the first operation a second one was performed, and a little later a third one, for the avowed purpose of removing little pieces of new-formed bones. Wassermann positive. (Author seems to attach much etiological importance to this reaction; in other such cases reaction was negative.) Face looks as if patient has adenoids and prognathism of left maxillary bone. Head inclined forward and downward. The physiological lordosis has disappeared. Thorax slightly inclined forward; arms fixed in the same direction as upper part of thorax, separated from it and in attitude to grasp an object. Osseous tumors in dorsalis longus, trapezius and both sacrolumbales; in fact, entire posterior wall of trunk. In upper movement of left trapezius a perfectly movable, painless, small, hard nodule. Lower extremities slightly flexed, left forming an obtuse angle with thighs. Double hallux valgus turned outward and metatarsophalangeal at nearly right angles with first metatarsal bone, covering with the lateral edge of the phalanges the second metatarsophalangeal articulation. There is a disturbance in the development of the two upper and inner incisors. They show an excrescence, which descends to the point of an implantation from the inner side to the middle of the teeth. The two rows of teeth do not meet together, and in the hard palate is a deep oval impression. The voluntary motions are limited by the described lesions. Left arm passes with difficulty just the horizontal line; right one appears as if glued to the side, its angle of motion not more than 30 degrees. Hands show thinness of little fingers and shortness of thumbs at expense of last phalanx (?). No X-ray of either hands or feet. Both testicles are ectopic, having remained in the inguinal canal near the external opening. Nothing else of note.

CASE CXV.—Reported by Seth Hirsch and Joseph Roth, in 1917. Male. Family history neg. First symptoms appeared at 2 years of age—lump on right side of neck. Lumps on neck disappeared. Other lumps developed below right scapula. Said in orthopedic hospital he had suffered from tuberculosis, applied a brace for nine months. It was then removed. Incision was made upon lump below right scapula. During last year the shoulders were becoming progressively displaced forward. Tonsils and adenoids were removed a year ago. Slimly built; walks about, but is constrained in movements of back and arms; shoulders very narrow, as though cramped forward. Calvarium shows at right parietal region large soft tumor about two inches in diameter, seemingly set into the bone. Both scapulae are tilted forward and seem to be fixed in relation to the ribs. A bony protuberance below right scapula. Some pain at movements of shoulder beyond difficult limitations. Very rigid spine throughout. (Pokerback.) Normal genitals. Shortenings of both thumbs and big toes. X-ray shows below the angle of the left scapula a large, rounded bony mass, and extending upward and inward a strip of bone located in the teres major. At the right side a large bony mass posteriorly behind the tenth and eleventh ribs, extending upward and outward into a rib-shaped prolongation, bounding the inferior axillary space and divides near the humerus into two small branches. This entire ossification is in the latissimus dorsi. In the right lumbar region opposite third and fourth lumbar vertebrae is an irregular stellate ossific shadow, and extending upward a linear mass merging with the body of the twelfth dorsal. On the left side runs an ossification strand from the lower ribs toward the iliac crest. Knees show a spur-like, bony formation from the posterior surface of the lower and of the left femur diaphysis. Also small ossification strand above its head. Thumbs and big toes show brachydactylia.

CASE CXVI.—Reported by Seth Hirsch and Joseph Roth, in April, 1917. Family history neg. First symptoms appeared at 6 months of age—small nodule on forehead, increasing in size to that of a plum, then remained stationary. Well after lump on



## MYOSITIS OSSIFICANS PROGRESSIVA

forehead till age of 8 years, when it was noticed that he could only raise the right arm with great difficulty. Soon after the left became similarly affected. Patient was removed to post-graduate hospital, where incisions were made over both scapulæ and pieces of a bony growth removed. Child got scarlet fever; returned home. Conditions progressed slowly, involving neck and rest of the spine. Later the lower extremities became also involved; boy still being able to walk with some difficulty. The disease shows signs of progression. Patient very thin, mentally active, able to walk with difficulty. Spine rigid and kyphotic, neck rigid, arms are adducted; he is unable to move them either outward or upward. Scars over both scapulæ from which portions of the osseous growth have been removed. There is a bony growth about the left frontal bone. The posterior muscles of the neck appear hard to the touch. The scapulæ are markedly winged. The upper extremities are fixed to the axillary border of the thorax. There are hard bony masses running from the serratus magnus on each side to the humerus. Posterior spinal muscles appear hard; there is marked rigidity of entire spine. There is marked contraction of the adductors and the *tensores fasciæ latæ*. The thighs are flexed on the pelvis, fixed and adducted; the legs are flexed on the thighs. Hard bony masses in the adductors and muscles of the calves. The genitals are normal. The big toes are considerably shortened. X-ray examination. Numerous strands of ossification in both *latissimi dorsi* and in many of the intercostal muscles of both sides. Examination of the pelvis shows numerous branch-like strands of ossification extending into the left gluteal group. A large spur-like mass of bone between the lesser trochanter and the right ischium. The knee shows a long spicule of bone springing from the posterior surface of the femur. Both big toes show brachydactylphalangia.

CASE CXVII.—Reported by Eug. L. Opie, in May, 1917. Male, aged 70 years. Nothing mentioned of previous history, description of skeleton only given. Subsequent course of disease unknown. Left internal pterygoid muscle ossified. The anterior edges and articular surfaces of the cervical and lumbar vertebræ show bony projections. Head and neck of seventh and eighth ribs ankylosed by bony union with the corresponding vertebræ. Broad bands about 2 cm. across connect on the right side of the fifth, sixth and seventh ribs about 2.5 cm. from their vertebral origin; the fourth and fifth ribs are similarly united on the left side. The bones of the shoulders and upper extremities show prominent ridges for the insertion of the muscles. No deformity of hand. Pelvis shows similar prominences and projections also on edges of acetabulum. Both femora show irregular ridge of bone 1 cm. high on the *linea aspera* just below the middle of shaft. Tibiæ and fibulæ very irregular in outlines. Rough areas with spiculæ project upward in the direction of the muscles. Bones are considerably thickened by periostitis; membranæ interossei are ossified at irregular places, forming ridges of bone. Right foot: porous texture of bones. Distal end of first metatarsal is enlarged and irregular in contour. Projecting downward and backward from the head of bone is irregular osteophyte 1 cm. long. Small bony projection, 3 cm. long and ankylosed, at the upper inner surface of the articular surface representing the two terminal phalanges of the great toe. These bones do not extend beyond the first interphalangeal point of second toe. Left foot: shows some porous texture of bones. Head of first metatarsal bone absent; end of bone broadened. Appearance of metatarsal bone as if its head, together with big toe, has been amputated. Microdactylia of both big toes (?).

CASE CXVIII.—Reported by Ten. Bokkel Hunink, in June, 1917. Female, aged 7 years. Family history neg. First symptoms appeared at 2½ years of age—swelling under chin. Swelling under chin disappeared; was followed by one in neck, causing stiffness. Had hard nodules on forehead, which also disappeared later. Mouth can only be opened ¼ cm. Flexion in elbow-joint to 90 degrees, extension to 120 degrees. Left shoulder hardly movable. Along the upper ribs many bone-hard swellings. The lower third of the left m. biceps feels like a bone-hard mass. The left axilla is entirely enclosed with bone-hard plates; no muscle to be felt. The muscles of the

## JULIUS ROSENSTIRN

neck, with the exception of the sternocleidomastoidei, are changed to a bone-hard mass. Large bone-hard plates in the long muscles of the back; also in the left latissimus dorsi. The medial edge of the right scapula merges into a bone-hard mass, which is fixed to the boneplates in the long extensor muscles of the back. Returned later with about the same status, only that the mouth can be opened wider and the muscles of the neck, which felt like a bone-hard mass at the first examination, now have grown softer, and though not as soft as ordinary muscles, no bone-hardness can be felt in them, and the movability of the head is accordingly improved. X-ray plates not shown in this publication, but author mentions that only in the chest and back the palpatory findings are confirmed by the X-ray, while the neck muscles show no ossification and the biceps show only a very small piece of bone in the muscular tissue. Bilateral microdactylia of both big and little toes; big toes have large first metatarsus and only one very small phalanx. (Synostoses?) Little toes very small phalanges.

CASE CXIX.—Reported by C. Johannesen, in 1917. Female, aged 2 years and 8 months. Family history neg. First symptoms appeared at 1 year and 8 months of age—swelling over skull and occiput. (Protub. occip.) Swellings were not sensitive. After four months later swelling over left shoulder, spreading to left scapular region and left side of neck to ear. It traveled in four to five days under left arm and across back. Not sensitive; no discoloration of skin. Arms could hardly be moved in shoulder-joints. After a week swellings began to disappear; instead a swelling appeared in left sternocleidomastoideus. After the left-sided swellings had disappeared swellings showed in right scapular region under right arm and lumbar region. About two weeks ago patient became sick; had chills; took to her bed and has lost flesh. Patient well developed. Height 88.5 cm., weight 13.8 kg. Head circumference 52, chest 54 cm.; anæmic; purulent discharge from both ears; nasal discharge and cough; chest and abdomen normal; temp. 37.2; pulse 92, regular; sits rigid; bends head forward and over to right side, with face toward left; opens mouth wide and masticates and swallows without difficulty; right side of neck and right fossa supraclavicularis are swollen; swelling of lower half of sternocleido. The inspection of right side of back shows swellings and grooves like topographic chart. Swellings in the neck in fossa supraclavic. continue over right part of back down to eleventh rib. Swellings in muscles of trapezius, axillary folds and serratus ant. They reach middle axillary line from second rib down to eighth rib. Swellings are bone-hard and immovable over underlying tissue. Skin normal appearance. Right arm stiff; left can be moved freely. Wassermann and v. Pirquet neg. Erythrocytes, 6,000,000. Leucocytes, 125,000. Urine nothing abnormal. Microdactylia of both thumbs and big toes. Hallux valgus bilateralis. According to Roentgen plates the thumbs show a shortened first metacarpus and both big toes a synostosis of a shortened first metatarsus, and first phalanx with a separate small last phalanx outward, resulting in bilateral hallux valgus.

CASE CXX.—Author's own case, in 1916. Male, aged 20 years. First symptoms congenital. Subsequent course of disease reported elsewhere in this text. Status at time of observation reported elsewhere in this text. Congenital abnormalities reported elsewhere in this text.

(TO BE CONTINUED)

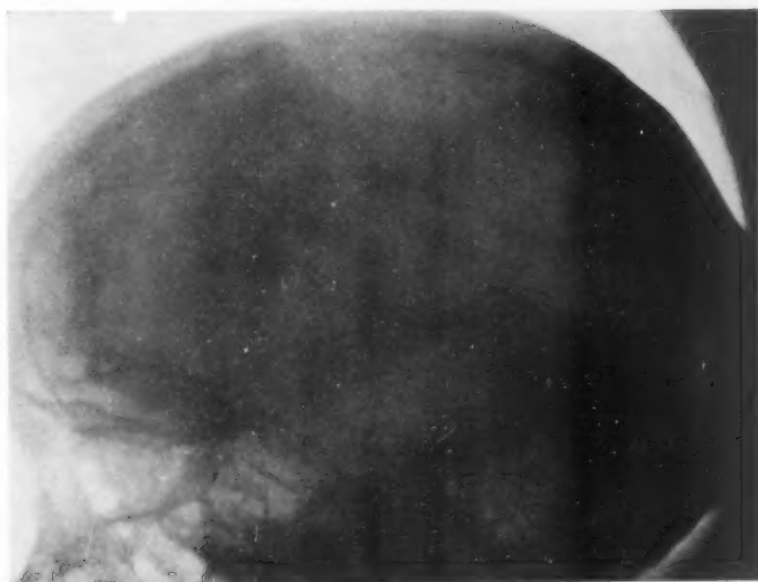


FIG. 1.—Mrs. M. No history of injury. Died from pulmonary lesion.

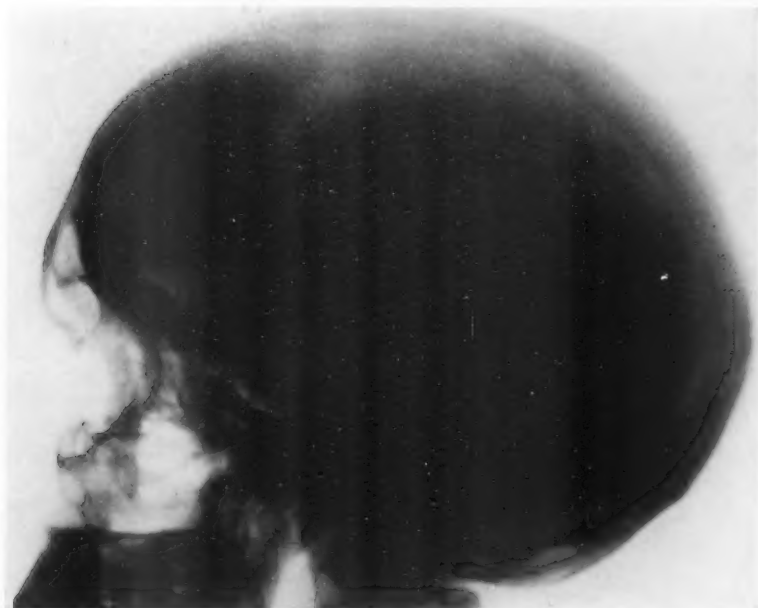


FIG. 2.—Mrs. J. No history of injury.

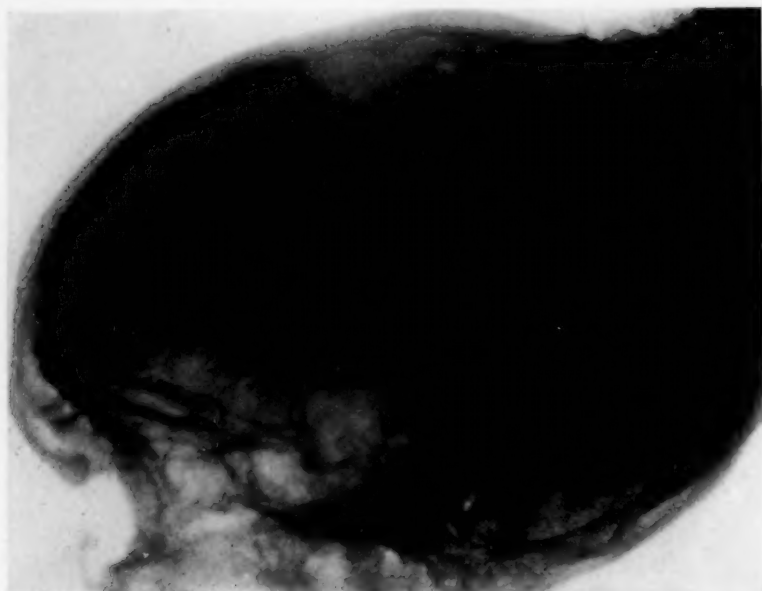


FIG. 3.—Mr. R. Injured nine years ago. Died from cerebral hemorrhage.

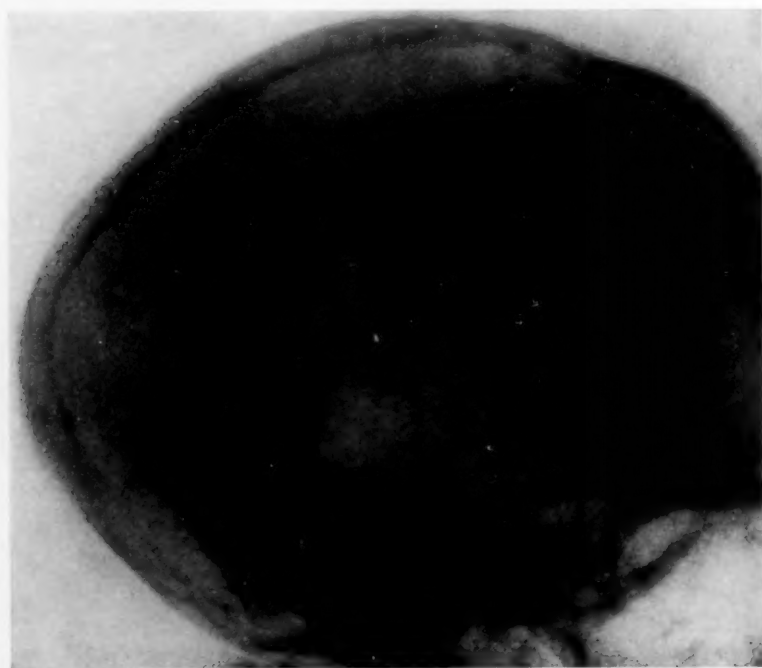


FIG. 4.—Mr. McM. Injury twenty-seven years ago.



**A RADIOLUCENT SEMILUNAR SHADOW OCCURRING AS A  
CONSTANT FACTOR IN CERTAIN CASES OF  
SEVERE INTERMITTENT HEADACHE**

PRELIMINARY REPORT

**By A. MERRILL MILLER, M.D.**

ATTENDING SURGEON TO LAKE VIEW HOSPITAL  
OF DANVILLE, ILLINOIS

AND

**E. G. C. WILLIAMS, M.D.**

DIAGNOSTICIAN IN CHARGE OF LAKE VIEW HOSPITAL LABORATORIES

EARLY in April of 1918 our attention was attracted to a shadow which was found on the skull plates of patients who were examined for possible cause of severe intermittent headaches. On single plates the shadow is semilunar in shape and lies immediately below the cranial vault. In stereoscopic plates it has the shape of an evaporating dish with one edge across the median line. Some cases show it on the left side and others on the right. At first it was thought to be an artifact or plate fault, but was found to be constant in all of the cases examined regardless of the position of the patient, tube or plate. Postero-anterior views of some of the cases show it corresponding in size and position with the findings of the lateral stereoscopic plates.

The cases which have shown this shadow give parallel histories. All have entered the hospital for the relief of severe intermittent headaches, which do not respond to the usual methods of treatment. The four cases which we present were all adults in middle life. Two of them were males, giving history of remote head injury, one of them nine years and the other twenty-seven years previous to entry to the hospital. Of the two females, neither had history of injury. One was decidedly neurotic. All cases were free from gross anatomical disease or lesion. One male showed marked change in disposition, being considered by his family as dangerous on account of violent attacks of anger from trivial causes. This is the only suggestion of mental instability shown by any of the cases.

Since this study was started two deaths have occurred. One male, who was injured nine years ago, died from cerebral hemorrhage, and one female from a pulmonary lesion.

As a cause for the appearance of this semilunar shadow as a constant factor in these cases, we offer the hypothesis that it is due to hydrostatic changes in the cerebrospinal cavity. What this change is we are not prepared to say, as this is a clinical rather than an experimental study. It is our feeling, however, that a study of intraspinal pressure in these and similar cases will illuminate the field.

## IMPORTANT POINTS RELATING TO THE SURGICAL TREATMENT OF PROSTATIC HYPERTROPHY

By ALBERT J. OCHSNER, M.D.

OF CHICAGO

ALTHOUGH it is practically impossible to determine the number of deaths attributable directly to hypertrophy of the prostate gland, it is a well-known fact that the number is enormous. A large proportion of these cases are classed under pyelitis, chronic nephritis, uræmia and pneumonia because these are the terminal conditions, which would, however, not have occurred except for the effects of the obstruction due to the prostatic hypertrophy with its secondary conditions.

All of these secondary conditions are due to a simple mechanical obstruction, and the question arises, Why is this obstruction permitted to continue? The diagnosis is easily made, the discomfort of the patient is sufficient to cause him to seek the physician's advice, and the prognosis without relief is sufficiently grave to warrant radical treatment.

Why is such treatment not an almost universal practice? There are a number of potent reasons. First, patients at the age at which this condition becomes troublesome are, as a rule, not good surgical risks; consequently, the surgeon's reputation is likely to suffer if he undertakes these operations readily. The elements of risk come, first, from shock; second, uræmia; third, loss of blood; fourth, anæsthesia; fifth, post-operative pneumonia, and, sixth, sepsis. Aside from this risk there is also the discomfort from post-operative conditions, such as the long-continued drainage and incontinence of urine.

All of these conditions can, however, be greatly modified, if not eliminated also completely, if the method of treatment about to be described is carefully followed.

The shock in these patients seems to be due to exposure to long-continued operation, rough manipulation, and loss of blood. After the introduction of the suprapubic method by Freyer, which reduces the time of operation to a fraction of the time consumed formerly, the element of shock was eliminated to a marked extent. This element is still further reduced by the operation about to be described. The danger from loss of blood has been reduced by proper tamponing, that of post-operative uræmia, by irrigation of the bladder continued for a period previous to the operation, and by preliminary suprapubic drainage. The danger from anæsthesia has been reduced by reducing the time of operation, by giving the patient a proper hypodermic dose of morphine and atropine previous to giving the anæsthetic, if general anæsthesia is used, and by the use of spinal anæsthesia. The same plan of treatment and placing the patient with the head of the bed elevated

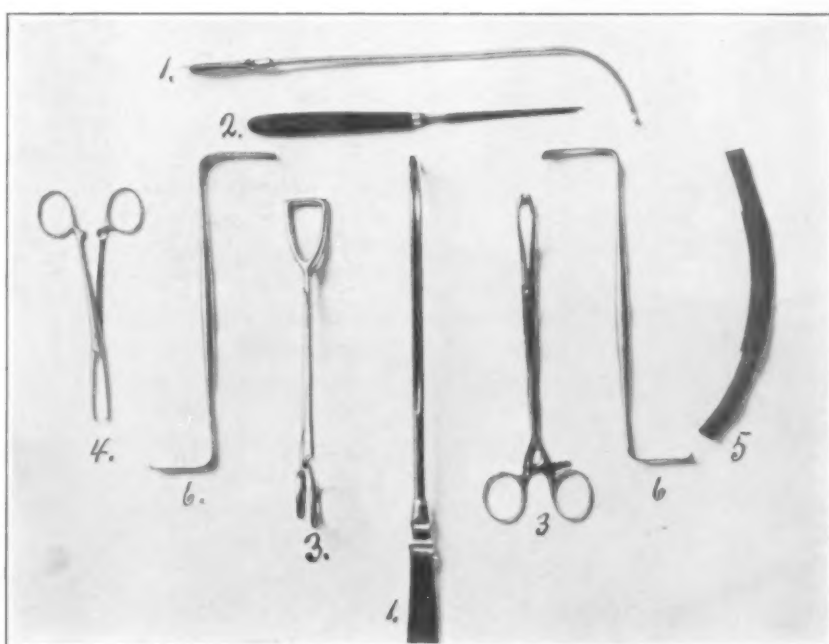


FIG. 1.

100



## TREATMENT OF PROSTATIC HYPERTROPHY

from 12 to 18 inches immediately after the operation, and having the patient accustomed to lying in bed before the operation, reduces the danger from pneumonia. All of these methods together with the method of operation have practically eliminated the danger from sepsis, because the trauma is reduced to a minimum and the drainage is ideal.

There is no doubt but what in the hands of expert operators any one of the operations that have been described during the last few years will result in a recovery in a very high percentage of patients, and that by applying these operations regularly in all cases suffering from obstruction many years could be added to the lives of men who now die directly or indirectly as a result of prostatic hypertrophy.

The method to be described contains all of the advantages of all of the various methods with a less number of disadvantages. It consists in the following steps:

The patient is properly prepared by vesical irrigations continued for some days or even weeks before the operation is to be performed. The urine is disinfected by the administration of urotropin; five grains dissolved in a glass of water and given every three hours has usually been found sufficient. In cases that are not suitable for any considerable operation, even after the above preparation, suprapubic drainage should be employed for several weeks previous to the removal of the prostate.

*Steps of the Operation.*—The patient is given a hypodermic of one-quarter ( $\frac{1}{4}$ ) of a grain of morphine and one-hundredth ( $\frac{1}{100}$ ) of a grain of atropine, half an hour before the ether is administered by the drop method.

Everything is in readiness so that no time whatever is lost from the beginning of the anæsthesia to the end of the operation.

The bladder is irrigated with permanganate of potash solution, and a sufficient amount is left in the bladder to cause it to be moderately distended but not sufficient to cause a possible rupture.

The patient is then placed in the lithotomy position and after dilating the sphincter ani muscle a grooved sound (Fig. 1) is introduced into the urethra down to the perineum.

An incision is then made corresponding to the lateral incision formerly practised in the operation of perineal lithotomy, extending from a point half-way between the scrotum and anus to a point half-way between the left tuber ischii and the anus, and extending down into the membranous urethra which is opened at this point sufficiently to admit the point of an old-fashioned lithotomy knife (Fig. 2).

The sound together with the lithotomy knife are then passed into the bladder, care being taken to carry the sound along the pubic bone in order to prevent the knife from cutting into the rectum, thus splitting the membranous and the prostatic urethra posteriorly.

The knife is then withdrawn, and the operator's finger is carried through the incision along the sound into the bladder.

The finger is now precisely in the same position in which it would be if a

suprapubic opening had been made, and in this fact lies the important advantage of this over other methods of operation, because beginning from above and entering the capsule of the prostate gland through the urethra one is in a position to enucleate the prostate precisely as though the bladder were entered from above and through the usual suprapubic incision, and one were to enucleate the prostate gland according to the Freyer method.

This step of the operation should be carried out with the utmost care in order not to disturb the bladder or urethra unduly. If bands of adhesions are encountered, a pair of blunt curved scissors should be carried along the finger and these bands should be cut. Presently the entire gland is free from its attachments to the urethra, and the capsule and gland are withdrawn through the perineal incision by means of Dr. Hugh Young's forceps (Fig. 3). The area is then carefully explored with the finger and occasionally an additional lobule of prostatic tissue is found which has to be enucleated.

The index finger of the left hand is then introduced into the neck of the bladder, and the capsule of the prostate is caught by means of a fine-tooth forceps (Fig. 4), one being applied to the right and one to the left, and a drainage tube consisting of an inner tube 1 cm. in diameter covered in its middle portion by a second rubber drainage tube just large enough to slip over the first one (Fig. 5) is introduced into the bladder, the inner tube extending into the bladder, and the outer tube into the capsule.

Ferguson's retractors (Fig. 6) are then applied to each side. The capsule is held in position by means of the fine-tooth forceps, the gauze is packed around the rubber tube into the capsule. The double tube prevents collapse, and offers a sufficient amount of resistance to make the tamponing effective for controlling the hemorrhage.

The rubber tube is held in place by means of silkworm-gut sutures which pass through the edge of the wound and the outer rubber tube.

Two days after the operation the tube and packing are removed. Occasionally, one encounters a prostate gland which is hard and fibrous and cannot be enucleated. In this case it is removed by gnawing away piecemeal under guidance of the finger by means of the Ferguson gnawing forceps.

The entire operation can usually be performed in less than fifteen minutes. The shock is minimal, the amount of traumatism is not extensive, and drainage is downward through the perineum in the most comfortable and most effective position.

After the removal of the drainage tube and tampon the patient can sit up. After the fifth day the patient can take daily tub baths and within two weeks the urine usually begins to pass normally.

I am convinced that no one who has tried this method will hesitate to relieve these patients by operative treatment.

The use of the grooved sound and the old-fashioned lithotomy knife, the method of attack from above, and the method of drainage and the placing the tampon are the special features.

## TREATMENT OF PROSTATIC HYPERTROPHY

The older surgeons who have practised perineal lithotomy before crushing of stones and suprapubic lithotomy had displaced this method can appreciate the ease and safety of this method and the value of the grooved sound and the old-fashioned lithotomy knife with its blunt point and its cutting shoulder, which will cut the posterior wall of the membranous and prostatic urethra without injuring other tissues.

The bladder being open, the next important step consists in carrying the finger into the bladder and working from above downward, precisely as though one were performing a suprapubic prostatectomy.

The anæsthesia can be discontinued after the first incision has been made because the operation will be completed before the patient realizes any pain. A very small amount of ether is required for this operation.

The operation can be performed with great ease under spinal anæsthesia. It is well to dilate the sphincter ani muscle before beginning the operation in order to increase the comfort of the patient during the few days directly following the operation.

The after-treatment consists in the administration of an abundance of distilled water and the giving of light diet.

The tube and tampon are removed after two days and the patient is permitted to get out of bed. After the fifth day he is given daily tub baths also an ounce of mineral oil at bedtime.

In case there is a tendency to the accumulation of phosphates in the wound, the patient is given two or three drops of dilute hydrochloric acid in half a pint of distilled water every hour until the phosphates disappear.

The post-operative course of these cases and the results are as uneventful and satisfactory as were these conditions in the perineal lithotomies.

## THE AMBULANCE AIRSHIP\*

A FACTOR MAKING FOR IMPROVED ARTICULATION BETWEEN THE MEDICAL DEPARTMENT AND  
THE FLYING OFFICE

By NORVELLE WALLACE SHARPE, M.D.

OF ST. LOUIS, MO.

CAPTAIN, MEDICAL CORPS, U. S. A.

QUITE independent of questions of humanitarianism and philanthropy, it is obvious that the rescue of the wounded, and their reclamation back to vigorous efficiency, is a wartime problem of prime importance. The modern army, divorced from its medical department and the usual activities compassed by a medical department, will degenerate, *ab initio*, into a defeated mob. It may be freely observed that salvaging the sick and wounded of the long established branches of the service offers problems that differ somewhat in types, but no basic differentiation is to be noted.

By contrast, however, not the least among sundry problems presented by, and peculiar to, the specialized air service is the most efficacious method of handling wounded flying officers. For the purpose of this article, reference is made, not to the surgical problems engendered by the air service, but rather to the procurement and transportation of the individual.

No special difficulty is encountered following casualties upon, or within the vicinity of, the flying field; particularly if the terrain be such that ambulances may be operated with reasonable ease. Difficulties multiply, however, when casualties occur remote from field or hospital, and upon a terrain difficult of access, or otherwise requiring an unreasonable loss of time. Nor should the fact be overlooked that airship casualties frequently include injuries to the cranium, vertebral column, thorax, abdomen (and those of the gravest type).

To meet the situation there has been developed a somewhat anomalous articulation between the flying office and the medical department. The former merely notifies the medical department of any accident (of which it may be cognizant) that occurs remote from the field; the latter coöperates by maintaining on the field a medical officer, with enlisted men of the medical detachment, an ambulance equipped with first-aid material, simple splints, dressings, axe, bolt cutter, and saw; and, in addition, holds itself subject to call, both day and night, for accidents that obtain remote from the field. It

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\* It may seem strange that a surgeon should attempt to solve a problem that would more naturally fall to the consideration of the Engineers of the Air Service, but to my mind the crux of the problem is a wounded man. Hence I have attempted its solution. In like manner it may seem strange to submit such an article to a surgical journal for publication, but I take it for granted that you would be glad to coöperate toward making successful a plan for salvaging wounded men.—NORVELLE W. SHARPE.



## THE AMBULANCE AIRSHIP

is but reciting a well known fact that such accidents (particularly in cross-country flights) may and do occur many miles distant, and, not infrequently, the ship and its occupants are so successfully obscured by their environment that discovery is a matter tedious of accomplishment, and entailing an enormous wastage of time and effort, together with an unavoidable prolongation of suffering and shock to the fallen and wounded aviator.

It is obvious that this articulation of the flying office with the medical department has superimposed upon the latter a burden of responsibility disproportionately onerous. But it is to be noted that the medical department, in accord with its honorable traditions, has coöperated faithfully and efficiently.

The following points are stressed:

The usual ambulance equipment and service are inadequate for this specialized problem;

The medical department thereby works under a handicap;

Valuable time is lost, and needless suffering and shock (to the fallen and wounded aviator) accrue.

The most satisfactory solution would seem to lie in an improvement of ambulance equipment and ambulance service; and an appropriate assumption by the flying office of a task hitherto carried by the medical department. In a word, the usual motor ambulance of the medical department should be replaced by an ambulance ship under the control of the flying office.

It is obvious that the ambulance ship would not be restrained by the handicap inherent to motor ambulances; and that the flying office should control the aerial ambulance devoted largely, if not wholly, to search for, and salvaging of, the wounded aviator.

I assume that this problem has presented itself to other minds, and that the ambulance ship, as a possible solution, has received consideration. In fact, I have studied one specimen built at Gerstner Field during the period when I was in charge of the Gerstner surgical service; but I am unaware, either from personal observation or the opinions expressed by medical, flying, or engineering, officers that the original problem (of the ambulance ship as a solution) has been satisfactorily settled.<sup>1</sup>

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<sup>1</sup> Of interest in this connection is the following notation sent me by Lieutenant Colonel Garrison, Acting Librarian, Library, Surgeon General's Office: "Replying to your letter of August 6, relative to ambulance airships, I regret to inform you that this office has nothing of this sort on file. \* \* \* we are unable to comply with your request and furnish you with such literature." Under ordinary circumstances one would assume that the dictum of the Librarian of the Surgeon General's Office would be the "last word." But, oddly enough, it chanced that while dictating these notes to a stenographer I was informed by a "trouble-shooter" that in England last year he had seen an ambulance built from a Livermore-Sunbeam-Coatellien, and that a memorandum concerning same had recently appeared in *Popular Mechanics*. Search in the Sacramento Library, through issues of 1918, proved fruitless, but a note in *Scientific American*, November 24, 1917, briefly recorded some experimental work of the French, conducted at the Villacoublay Aerodrome, with an aeroplane ambulance.

## NORVELLE WALLACE SHARPE

As a contribution toward such solution, I submit the accompanying drawings of an ambulance ship (Figs. 1 and 2).

In contradistinction to any ship so built that the patient is compelled to sit in a more or less erect posture, this ambulance has been designed primarily for the welfare of the patient, his personal comfort, and his personal safety. It will be observed that no alteration of the stream-line fuselage has been made, nor alteration of the fuselage that would involve a structural weakening; that the requisite alterations are simple in design, inexpensive in material and labor, and well within the capability of the shop personnel of the flying field. The proposed ambulance ship may be built at the factory—but, equally well, may be constructed from a JN4D airplane in the shops of any properly equipped flying field.

The instrument board of the forward cockpit has been re-enforced by the customary supply of the rear cockpit. The latter has been abolished, and a chamber developed within the fuselage for the carriage of a litter and a man, with a maximum clearance of 17 inches and a minimum of 14 inches. Substantial modification of Stations 5, 6 and 7 has been made, and ancillary longerons (to serve as a bed for the litter) introduced as shown in Cross Section Drawing 208. This modification has compelled the removal of the top horizontal tuning wires, and the fuselage cross section wires of, and between, Stations 5, 6 and 7. In compensation is offered the bracing system exhibited in Cross Section Drawing 208 and Drawing 302.

I have been assured by the engineering office of Mather Field that the ambulance fuselage is fully as strong as the original type; and, in fact, (due to the method of engaging the litter in the litter chamber, and the additional horizontal tuning wires introduced in the opening that was formerly the rear cockpit) substantially stiffened in its longitudinal axis.

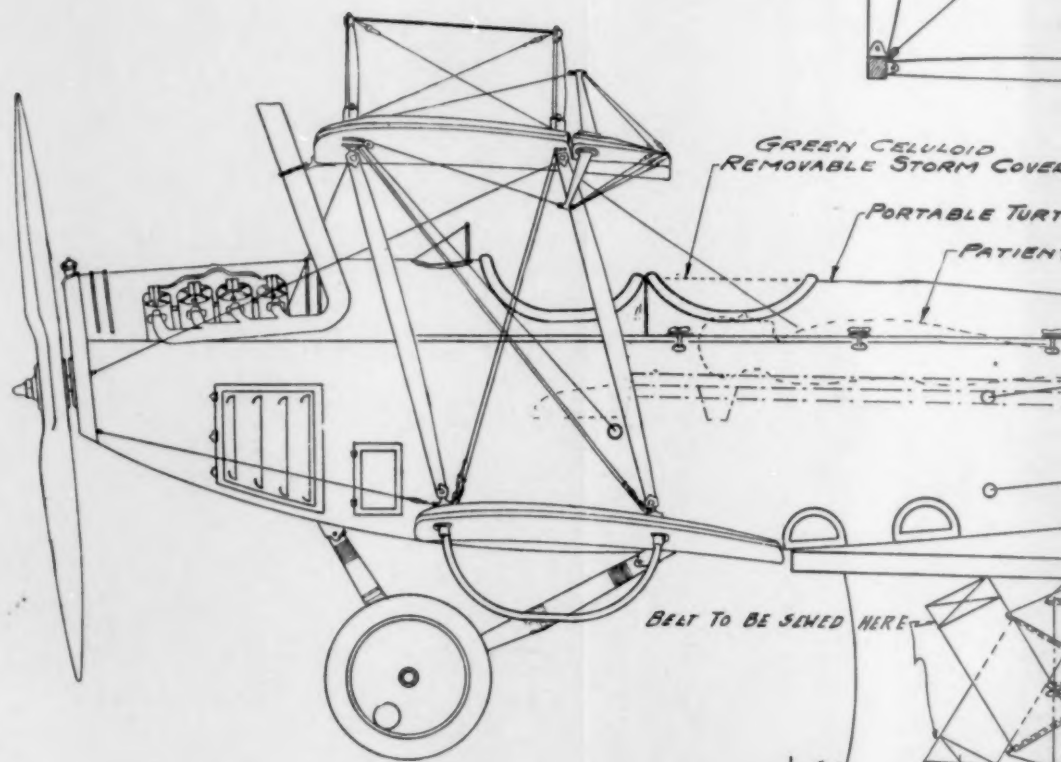
The usual turtle-back is unchanged, save that a stronger and more dependable locking device has been employed. (See detail Drawing 302).

Additional protection against the air (especially in case of pronounced shock) may be secured by clamping into place the translucent celluloid shield indicated in Drawing 208. The use of this shield is optional. The litter (Drawing 208) is essentially the service litter with but scant modification. The stirrup feet have been replaced by strap iron feet of simple design and less weight, so placed that they will escape the fuselage longerons. The hinged braces have been replaced by lighter rigid iron braces. The former rectangular canvas bed has been slightly tapered toward the feet to conform to the usual taper of the fuselage.

Strong clamps, activating on the eccentric principle and attached to the longeron litter bed (detail, Drawing 302), engage in the litter longerons, which have been suitably metal-sheathed for their reception.

Substantial web belting with safety buckles (of the type commonly employed in the cockpits) pass over the patient at the level of the knees, the pelvis and the lower thorax. To control the possibility of the body slipping (in the event of forced acrobatics), similar belting, strongly attached, on

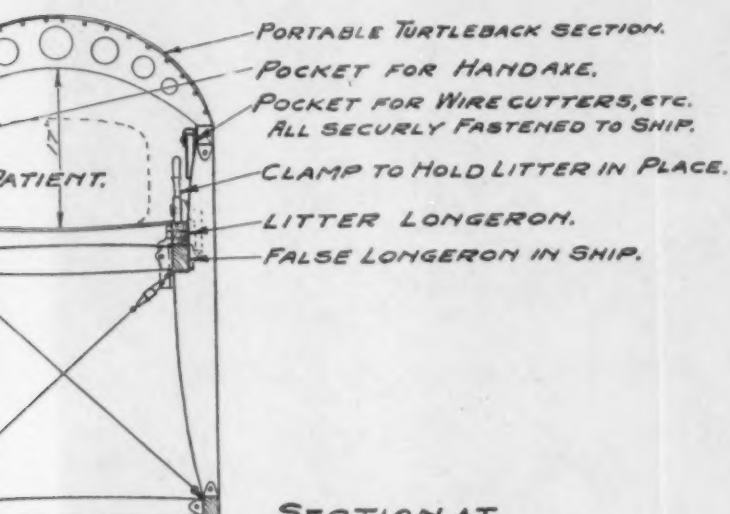




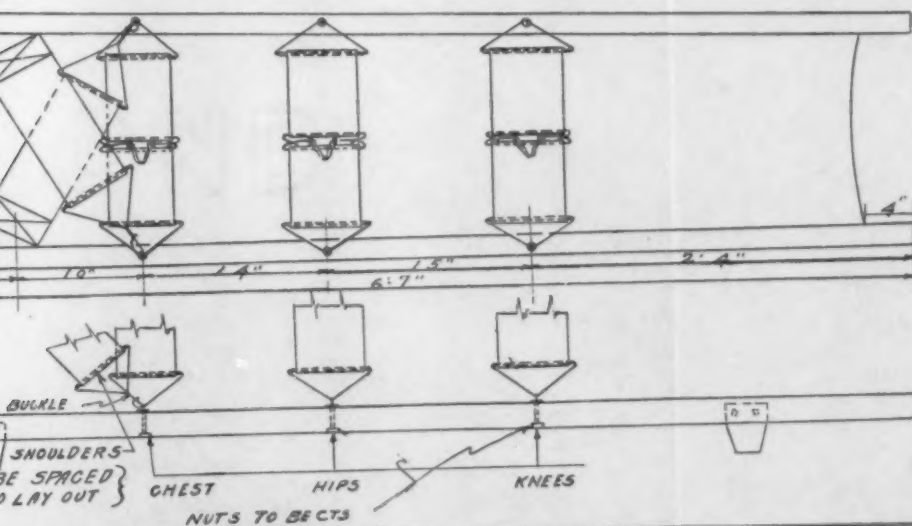
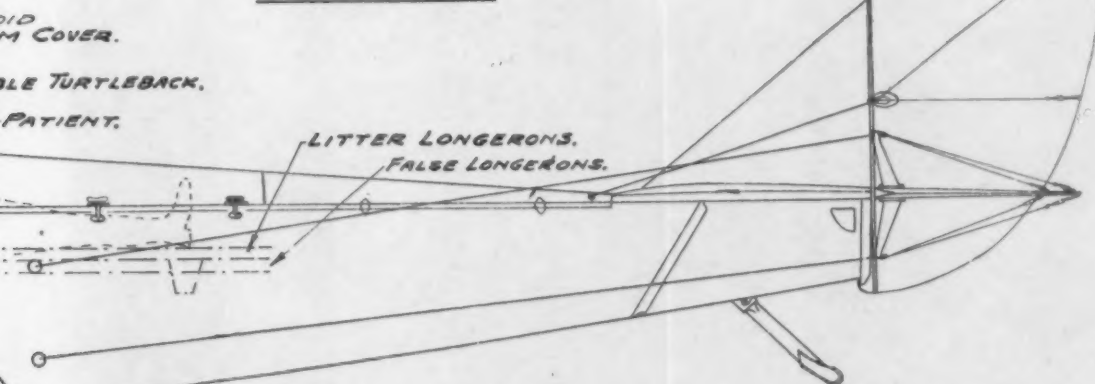
-PROFILE OF-  
-CURTISS JN4D-

FIG. 1





### SECTION AT STATION N° 7



DESIGNED UNDER DIRECTION  
OF  
NORVELLE WALLACE SHARPE.  
CAPTAIN, M.C. U.S.A.

ENGINEERING DEPT.  
AIR SERVICE TRAINING SCHOOL  
MATHER FIELD, SACRAMENTO, CAL.

#### PROPOSED AMBULANCE SHIP

Drawn	S.F.	Approved	
Traced	V	Approved	
Checked		Approved	
Date	8-14-18	Scale	As Noted
		Revised	
		Dwg. No.	208

SECTION THRU STRUT  
 20 GAUGE STEEL  
 3/4" x 1/4" FOR STRUTS

SECTION E-E

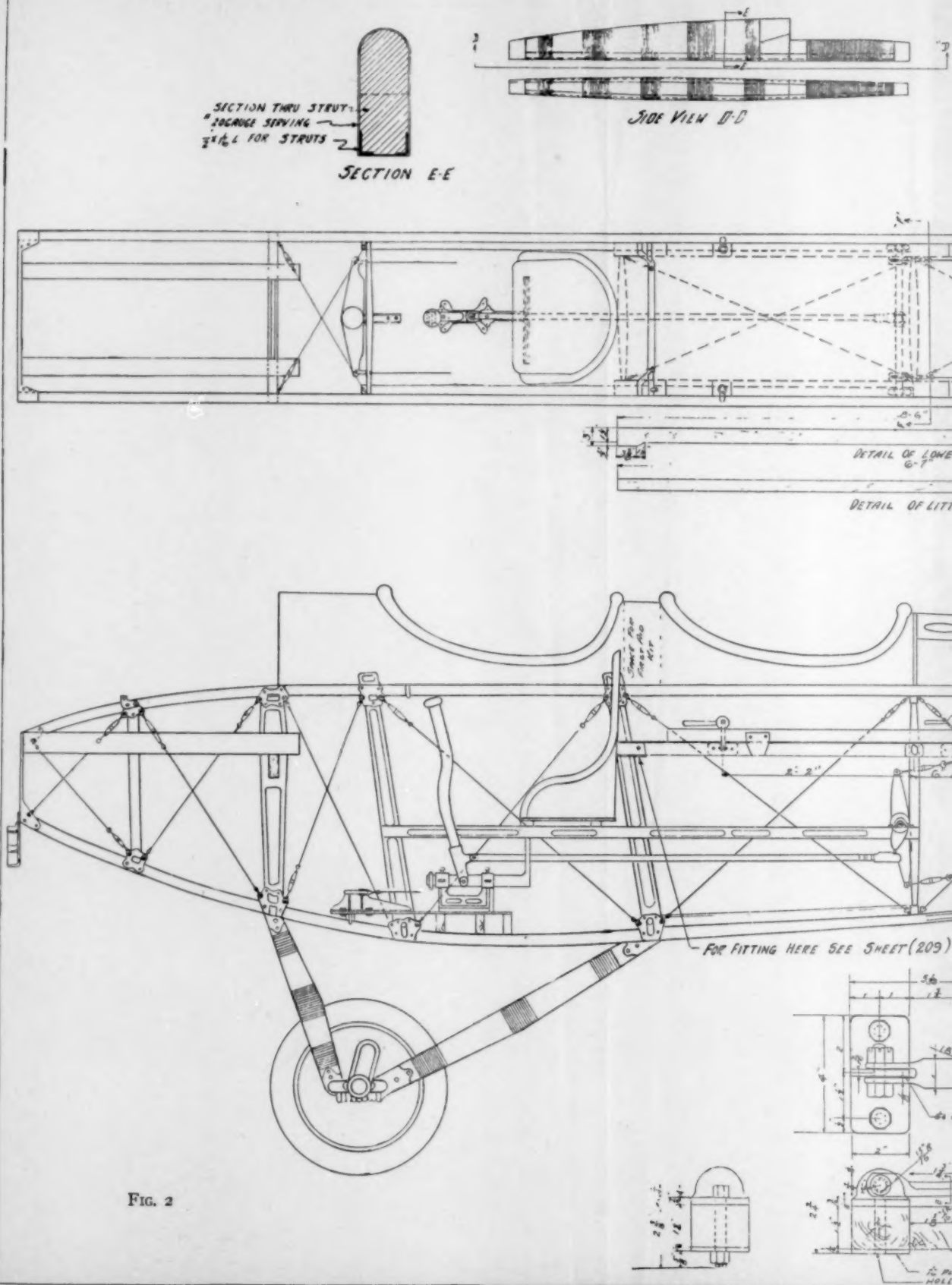
SIDE VIEW D-D

DETAIL OF LOWER

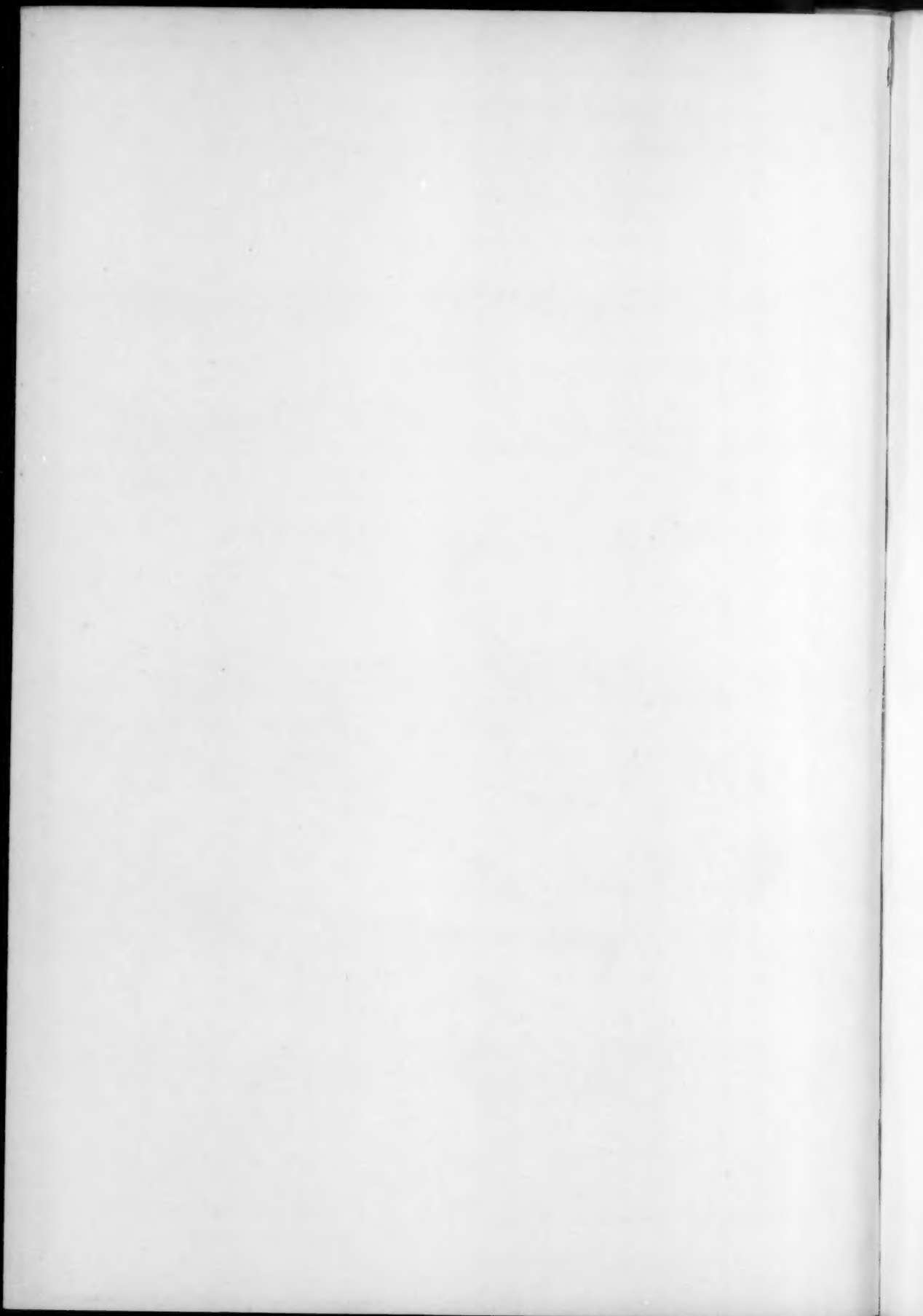
DETAIL OF LIFT

FOR FITTING HERE SEE SHEET (209)

FIG. 2









## THE AMBULANCE AIRSHIP

either side of the head, to the re-enforced canvas of the litter, passes over each shoulder to decussate at the mid-sternal line and find attachment, on the litter longerons, at the points which likewise control the chest belt. It seems highly improbable that the patient (well wrapped in blankets over which the belting should engage snugly) will appreciably shift position, even though the ambulance ship, pursued by the enemy, be compelled to engage in acrobatics.

The general plan of this ambulance ship would seem to be capable of ready adaptation to any ship, domestic or foreign, whose fuselage approximates in type the JN4D, and whose structure and power warrant the transportation of two men. Parenthetically, it may be noted that the burden of this ship, when loaded, is but slightly in excess of an unaltered twin ship carrying two men and the usual equipment. Furthermore, it is of practical interest that the weight centers of this ambulance ship will not be altered to any significant extent.

The ambulance airship should be distinctively differentiated from other ships. To that end it would seem wise that the entire color scheme be either white or cream-white; and that upon the upper surface of the upper wings and the lower surface of the lower wings, likewise upon the sides of the fuselage, the Geneva Cross, in brilliant red, be boldly displayed.

Such distinctive differentiation is likewise advised for ambulance ships in "the zone of the advance"; though it were but fatuous cherishing of a fond delusion to assume that the gentle Teutonic art of "schrecklichkeit" toward the sick and wounded, would be modified in favor of an aerial ambulance, be it differentiated ever so clearly.

Standard equipment should include an axe, a saw, pair of heavy bolt cutters, mesh splints, tourniquet, aromatic spirits of ammonia, hypodermic case, canteen of fresh water; not less than two substantial wool blankets should be included, and a vacuum bottle, replenished daily with hot coffee or hot soup, may prove of the greatest life-saving value, especially during the rigorous winter months. A first aid cabinet, extending the width of the fuselage (to house these necessary articles) will prove quite accessible, if carried as indicated in drawings 208 and 302.

But, as two men are requisite for proper manipulation of the patient, *two ships invariably should be sent to all remote plane accidents*: Ship 1 (ambulance) carrying pilot and empty litter; Ship 2 (ordinary) carrying flying officer and passenger (any ordinarily intelligent man will serve).

Without engaging in any comparison with other ambulances, the following technique is submitted for consideration, and attention is directed to its simplicity and effectiveness from the standpoint of the aviator-patient.

At the earliest moment following notice of a remote accident, the ambulance ship, accompanied by a companion ship (as above noted), proceeds to the indicated vicinity. A thorough search of the terrain by the two ships should identify the wreckage with reasonable promptitude; landing is accomplished; the aviator is freed from the wreckage (saw, axe and bolt-cut-

NORVELLE WALLACE SHARPE

ters carried by ambulance ship); lifted on blanket covered litter; first-aid relief extended (all material carried by ambulance ship); wrapped snugly in blankets; strapped on litter; deposited in ambulance-fuselage-litter-chamber; litter clamped into position; turtleback and celluloid shield clamped in position; return flight begun.

Note: *The patient is handled but once.*

On reaching the field, patient (strapped on litter) is removed from the ambulance ship; transported to operating room; removed to operating table, again being handled but once.

NOTE.—Cordial recognition is made for the helpful coöperation and counsel tendered by Capt. Sylvanus C. Coon, Lieut. Royal Miller, Lieut. Mead T. Mulvihill, Lieut. Murray S. Vosburg and Lieut. S. S. Kingman.

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting, Held October 9, 1918*

The President, DR. CHARLES H. PECK, in the Chair

## COMPOUND COMMINUTED FRACTURE OF THE LEG

DR. JAMES M. HITZROT presented a man aged twenty-nine, who was admitted to the New York Hospital on September 23, 1915, with a history of having fallen two stories from a scaffold. He was brought by the ambulance to the hospital and sent to the operating room immediately. There were open fractures of both legs in the middle third. Both tibiae were extensively comminuted. On the right side, the lower fragment was protruding from the leg.

*Operation.*—Iodine skin preparation. Right leg: The extensive skin wound was enlarged, and the wound trimmed away to healthy skin. The leg was fractured from the middle half to just below the tubercle of the tibia, all the bone in that particular region being comminuted, the number of fragments being possibly eight. The lower end projected through a large lacerated wound and the upper fragments were driven into the muscles of the calf. A Quenu-Mathieu extension apparatus was applied. By turning the extension screws, the comminuted fragments were drawn into fair alignment. The wound was then filled with balsam of Peru, dressed with gauze dampened with saline, and left wide open. Only one small bone fragment was removed, the others all having periosteal attachments.

The instrument used did not prevent a certain amount of lateral rotation in this particular case, so that the displacement of the bones could not be said to be absolutely overcome. It did, however, maintain alignment and allow for easy access to the wound.

Left leg: The region of the fracture in the left leg was exposed by a 4-inch incision and practically the same condition was found as in the right leg, except that the comminution was not so extensive. A Freeman external bone clamp was applied so that the screws were fastened in the normal bone above and below the line of fracture and the fracture reduced, alignment in this instance being maintained very satisfactorily. The wound was filled with balsam and the skin incision loosely closed with silkworm-gut stitches, leaving three or four narrow openings through which the exudate could escape. The wound was then dressed with saline and both legs put up in Volkmann gutter splints.

## NEW YORK SURGICAL SOCIETY

Four days after the operation, a superficial infection developed in the right leg with the greyish sloughy appearance characteristic of gas bacillus infection. Smears showed a large Gram-positive organism of the capsulatus aërogenes type—subsequently reported as *Bac. aërogenes capsulatus* (Welchii) from culture. The leg was irrigated with 1 per cent. formalin and dressed with peroxide. After two days the character of the infection changed and the odor disappeared.

The patient ran a temperature of only 101.5 but was unusually restless, and on the seventh day the left leg was found so twisted that the two upper screws of the Freeman clamp were twisted out of the bone. On the ninth day an infection developed in the left leg which remained quite superficial (albus and colon) and did not involve the bone.

On the twenty-fourth day after operation, the Quenu-Mathieu apparatus was removed and a fragment of dead bone picked out of the wound. The perforating points of the drills were touched up with silver nitrate. The wound was dressed with balsam of Peru and Volkmann tin splints applied.

On December 15, the granulating surfaces of the legs were cleaned with soap, water and benzine. Quite a marked degree of union was found in the left leg in which there was hardly any motion at all. A short posterior moulded plaster splint extending from below the knee was applied. The right leg still had considerable lateral anterior posterior motion at the site of the fracture with practically no motion at the knee joint. Long posterior and external lateral splints were applied, extending above the knee.

The patient was in the hospital 132 days. Upon discharge, the left leg was solid and the wound was almost healed. The right leg was firm but not solid, and there was a discharging granulation area about the centre of the leg. One month later, on the one hundred and fifty-fourth day, the right leg was solid and the patient was allowed to walk on it without crutches.

The man now has good function in both legs and works daily.

DR. JAMES M. HITZROT also presented a man, aged twenty-four, who was brought to the New York Hospital on October 31, 1917, with a history of having been crushed between the front of a trolley car and a wagon. On admission he had suffusion of the upper chest, neck and face, an abrasion over the back, and an open fracture of the left leg with extensive skin destruction and laceration. The patient was brought to the operating room about one hour after his injuries.

*Operation.*—Iodine skin preparation. The devitalized skin over the anterior edge of the tibia was carefully excised and the wound opened so as to expose the entire line of fracture. The middle third of the bone and a little of the upper third were extensively comminuted, the bone being crushed into twelve or more fragments. The dorsal extensor muscles of the foot were extensively lacerated and in many places completely cut in two. All of the devitalized muscle tissue, the loose fragments of bone which had no attach-



## COMPOUND COMMINUTED FRACTURE OF THE LEG

ment, and the shredded fascial sheath of these muscles were carefully excised, and all pockets carefully opened. The entire wound was then irrigated with 1 per cent. formalin solution followed by ten volume peroxide and then irrigated with normal saline solution. The extensive loss of the bone made it impossible to fix the distal portion of the leg in appliance directly used on the outside. A Quenu-Mathieu apparatus was applied, the two fixation pins being passed through the tibia above and below the line of fracture, after which the bone fragments could be held in more or less satisfactory position. The wound was then dressed and the leg put up in a Volkmann tin gutter splint.

On the fourth day, Dakin-Carrel treatment of the wound began. On the fifth day, the skin over the posterior aspect of the leg about the middle was found to be dead, and this was excised from time to time.

On the ninth day, a purulent exudate began to show itself, especially on the marrow surfaces of the fragments of bone.

At the end of two weeks the leg was put up in moulded plaster splints with strip steel reinforcement, but this proved unsatisfactory because of the moisture, and in the seventh week, the patient was put up in a Hodgen splint using the lower pin of the Quenu-Mathieu apparatus for extension. The upper pin was removed at the same time.

The amount of the infection was readily controlled by the Dakin-Carrel treatment but increased in amount each time dichloramine-T was used. This infection was maintained chiefly about the bone fragments, especially on the medullary surface. It was deemed unwise to remove these, as new bone was forming from the periosteal side of these fragments until the seventy-seventh day, when they had loosened and were easily removed, after which the infection rapidly decreased. On the eighty-ninth day a portion of the large granulating area was skin-grafted (Thiersch method).

The leg was placed in moulded plaster splints and the patient allowed up on the ninety-sixth day.

On the one hundred and twenty-sixth day there was a gap of  $1\frac{3}{4}$  inches between the upper and lower side of the newly formed bone. To bridge this gap, an operation with bone graft was done, although it was realized that the graft could not be placed in an absolutely sterile field. A six-inch graft was placed across the gap (inlay) removed from the opposite tibia (March 13, 1918). On the twelfth day after operation, a small infection formed over the centre of the graft and the graft became loose and was removed on the forty-sixth day. New bone had formed at both ends in the region of the graft, and only in the region of the early infection was there an absence of bone formation (eleven and one-half months).

There is now  $\frac{3}{4}$ -inch of separation between the bone ends, but the X-ray plate shows new bone growing up the posterior aspect of the gap and the patient is wearing a brace to await developments.

The case is shown to illustrate how a satisfactory leg may be obtained

## NEW YORK SURGICAL SOCIETY

after an extensive injury which at first seemed to warrant amputation. The first case shown, taken as a standard, shows how much this second man may eventually expect.

### COMPOUND FRACTURE OF THE ELBOW

DR. JAMES M. HITZROT presented a man, aged thirty-seven, who was brought to the New York Hospital with a history of falling through an open hatch, a distance of twenty-two feet, striking on the right elbow.

On admission he was found to have an open fracture of the olecranon, with anterior displacement of the forearm on the humerus. Three and one-half hours after injury, he was taken to the operating room.

*Operation.*—Iodine skin preparation. Under the anæsthetic, the whole olecranon process and portion of the shaft of the ulna were found to be smashed. The opening through the skin connected with the open elbow joint. This opening was excised and the whole region of the fracture exposed by a long linear incision. There were three loose fragments of bone on the radial side of the olecranon and one smaller fragment was attached to the internal lateral ligament. As this fragment could not be controlled and was quite small, it was likewise excised with the loose fragments. A heavy plain catgut suture was then passed through drill holes in the ulna, and through the triceps tendon at its attachment to the olecranon and drawn taut. This approximated the bone fragments satisfactorily. Interrupted plain catgut stitches were then passed through the torn expansion and through the muscles, approximating them around the fractured area and closing off the elbow-joint. During the operation, the elbow-joint was washed with saline solution. The skin was closed with interrupted silkworm without drainage and the arm put up in an anterior moulded plaster splint.

The wound healed by primary union. It is now thirty-four days after the operation, and the patient can flex the arm thirty degrees plus, and has free motion without pain for that distance. He is receiving massage and the motion is steadily increasing.

DR. CHARLES H. PECK said that these cases illustrate in a way the tendency that is seen so much in war wounds to save limbs after extensive comminution of bone. This effort is proving successful in a great many cases by conserving most of the fragments that have any periosteal attachment and removing those only completely detached and keeping the line of the wound clean. The early mechanical sterilization of the wound is successful in a large number of cases; and is one of the points in treatment which is being carried out extensively and successfully in saving limbs which otherwise might require amputation.

DR. FRED H. ALBEE (by invitation) said that at General Hospital No. 3 there have been a large number of returned cases showing that bone fragments comminuted by fracture do live and in many cases completely restore the shaft of a long bone. Of the large number of such cases coming under

## POST-OPERATIVE VENTRAL HERNIA

his observation he had been especially interested in a case which illustrated this point well. In an infected compound comminuted fracture from gunshot injury there were a large number of necrotic bone fragments from the effect of the infection which ensued at the time of injury three months before; one piece, however, had been driven so far out into the muscle by the high velocity of the bullet that it had become walled off from the infected pocket and its cells escaped death. The amount of subsequent bone growth from this fragment was very striking. In fact the fragment had tripled its size.

He wished to reiterate that he has found that these fragments will live and help restore the loss of bone even though they may be entirely detached.

## POST-OPERATIVE VENTRAL HERNIA WITH PROLAPSE OF EXCLUDED ILEOCÆCUM

DR. SETH MILLIKEN presented a boy who was admitted to the second Surgical Division in Roosevelt Hospital, September 11, 1918. His history was that two years ago he had been operated on for acute appendicitis at a hospital out of town. A fecal fistula developed following the operation and about a year ago at a hospital, said to be in the city, but where the record is not available, he was operated on again and says that the small intestine was joined into the large intestine and that since then no feces have come through the old wound, but that the bowel has come out.

Examination shows a large mass of large intestine prolapsed through a right intermuscular defect into which the entire hand can be inserted, that is, the hernial ring is about four inches in diameter. The boy is well developed and bright and complains of the mass on the abdomen.

There was a large median firm scar and at the site of the intermuscular incision there protruded the mucous membrane of the cæcum, a short portion of the ascending colon and a portion of the ileum. Finger exploration of this mass when re-introduced showed apparently a blind end of the ileum, but no obstruction in attempting to pass up the ascending colon. Barium injected into the opening of the mass gave an X-ray picture which apparently showed normal ileum, cæcum and ascending colon, but on close inspection it seems that the ileum proper went into the hepatic side of the transverse colon.

*Operation* (September 16, 1918).—Under ether anæsthesia the prolapsed gut was inverted into the abdomen and packed with gauze. The entire surface was thoroughly swabbed with iodine and an incision carried around the former scar about a quarter of an inch from the margin of the hernia and dissected up so that the two margins of the wound to be excised could be sutured together. This was done and the opposed surfaces swabbed with pure carbolic and a towel clamped about the opening. The wound margin was then re-swabbed with iodine and the operation proceeded with by dissecting down and opening the peritoneum and circumcising the margin of the

## NEW YORK SURGICAL SOCIETY

hernia. There were very few slight adhesions in the iliac fossa which were easily separated without bleeding. The wound was sufficiently large to retract easily upward and revealed a side-to-side anastomosis of the ileum and the transverse colon with the closed end of ileum toward the right. The ascending colon was freed and crushed off near the hepatic flexure with a Payr clamp and the cæcum and ascending colon removed. The crushed margin was seared with phenol and a running stitch passed over the clamp into which the end was inverted. A second Lembert stitch of linen was placed over this end reinforced with interrupted Lembert stitches as a third layer. There were no apparent soiling of the peritoneum. The peritoneum was closed in layers and the muscles freed slightly so as to give three distinct layers. These were united under considerable tension in layers and the aponeurosis firmly united with plain gut anteriorly. The skin was approximated with silkworm gut and silk after thoroughly cleansing the surface of the wound before closing the skin. Silkworm gut twist drain was inserted in the lower angle of the skin wound, no drain being inserted below the aponeurosis.

The boy made an uneventful convalescence following his operation, except that three small areas of infection developed in the length of the wound in the skin. These have drained superficially and are healing by granulation at this time.

### HOSPITALS OF THE AMERICAN EXPEDITIONARY FORCE

DR. CHARLES H. PECK presented a paper with the above title, for which see page 463.

### LIPOMA OF THE THIGH

DR. WILLIAM B. COLEY presented a specimen, a very large lipoma of the thigh which had been removed on the morning of the same day, October 9th. The patient, a woman thirty-five years of age, first noticed a swelling in the posterior and middle portion of the right thigh about seven years ago. The tumor gradually increased in size until it had reached such large proportions that it was regarded as inoperable.

This case is particularly interesting from a diagnostic standpoint. She was admitted to the Memorial Hospital on the supposition that the trouble was a sarcoma of the muscles of the thigh. However, on a careful examination of the tumor in connection with the history of its development there were a number of features which favored a diagnosis of lipoma. First, the very slow growth of the tumor (seven years) was against its being a sarcoma. Second, the mobility of the tumor was much more marked than one would expect to find in a tumor of either fascial or muscular origin. Third, the consistence of the tumor was so soft that it closely simulated a cyst. Introduction of an aspirating needle, however, brought no fluid, thereby showing that it could not be a cyst. Had it been a vascular sarcoma it would have been possible to obtain a few drops of blood with a needle.



### LIPOMA OF THE THIGH

The diagnosis of lipoma was confirmed by an exploratory operation in December, 1917, and the question of removal of the tumor was carefully discussed. Operation was not strongly urged on account of the large size of the tumor. The patient went home and returned again two weeks ago, at this time being willing to have the operation performed. She had had six X-ray treatments in this interval without any noticeable effect. On October 9th, under ether anæsthesia, Doctor Coley, with the assistance of Doctor Hoguet, operated and the lipoma was shelled out with perfect ease, and there was practically no hemorrhage. A considerable portion of redundant skin was removed along with the tumor. The lipoma weighed 7 pounds.

TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting, held January 7, 1918*

The President, DR. CHARLES H. FRAZIER, in the Chair

THE DANGER OF THE PERNICIOUS BOND SPLINT IN CARPAL  
FRACTURES OF THE RADIUS

DR. JOHN B. ROBERTS said that successful treatment of the usual fractures near the carpal end of the radius demands: (1) Free separation of the basal from the shaft fragment, whether impacted or entangled. (2) Forcible reduction until the normal arch of the palmar surface of the radius near the wrist is restored. (3) Retention of this concave anterior surface of the carpal fifth of the radius. (4) A flexed wrist-joint during convalescence and abstinence from the use of a flat splint for support, on the palmar aspect of the forearm and hand, aid greatly in preventing displacement of the carpal piece after its reduction. This is particularly the case in comminution of the lower fragment.

In his opinion "Bond's splint," so much used in Philadelphia, is an anachronism and should be discarded from use as a dressing for these fractures.

(a) Some of them need no other dressing after reduction than flexion of the wrist-joint maintained by a rigid material.

(b) Others require a straight strip of wood or metal on the dorsal surface from mid-forearm to metacarpal-phalangeal joint or a convex incompressible splint of cork, wood, metal, or hardened plastic material to support the arch in the anterior surface of the lower fifth of the radius.

(c) Still others, because of severity of the vulnerating force or brittleness of bone, do better by being encased in a Levis splint of swedged copper on the palmar surface of the forearm and palm of hand, or else a molded gypsum gauze splint covering the dorsum of the forearm and hand, applied before the plaster of Paris is set. Both of these dressings should keep the wrist flexed during their use because the extensor tendons have a tendency to hold the fragments in place. These conformed dressings usually are not needed for more than three or four weeks, even in severe injuries.

In illustration of these statements he described a case in which the original fracture, not originally under his care, had been apparently a comminuted and backward displaced fracture of the lower end of the bone. A Bond splint had been applied with a pad of gauze under the lower end of the radius with the idea of holding the fracture in adjustment. When seen by him three weeks after injury, there was marked prominence of the head of the

## IMPASSABLE TRAUMATIC STRICTURE OF THE DEEP URETHRA

ulna at the back of the wrist and some displacement of the carpal fragment forward. The patient was suffering great pain until he removed the dressing and substituted a gypsum gauze retentive apparatus until he could persuade her to take ether and allow him to reconstruct the lower end of the bone. She delayed this operation for about three weeks. He then, under ether, pushed the lower fragment upward so as to bring it into proper apposition with the shaft. The deformity due to the apparent dislocation of the head of the ulna disappeared.

This confirmed his opinion that the lower fragment of the radius, because of the use of the Bond splint and a possible mal-adjustment during the first three weeks after injury, had been displaced forward without rupture of the radio-ulnar ligaments. This gave the appearance of a radio-ulnar dislocation.

He had seen fractures with backward displacement treated with the Bond splint in which the displacement had apparently been reproduced by the support not being properly obtained under the arch on the palmar surface of the lower part of the shaft. He thought that in the case now reported the pad of the Bond splint, which goes in the palm of the hand, probably caused the secondary deformity by reason of causing motion at the seat of fracture instead of at the wrist-joint. This is his explanation of the change during the Bond splint treatment from a backward displacement to an anterior displacement of the carpal fragment. He believed the Bond splint to be a dangerous form of splint for fractures of the base of the radius. It should be discarded from the surgeon's outfit.

DR. JOSEPH M. SPELLISSY thought that the Bond splint, which Doctor Roberts condemned, could be used with great advantage if it were properly padded. The arch of the wrist needs to be preserved. Of course, if the Bond splint is used without building up, the hand is thrown into the wrong position, aggravating the deformity. Oakum can be used to advantage for padding, since it is soft but can be molded into shape and is better than gauze. If the fracture be reduced over the knee and the hand put in the proper position, it has the grasp needed, the oakum fills up the space and if necessary repeated dressings can be inserted under the lint used to cover the oakum. The splint takes up very much less room and is less expensive than the more elaborate forms.

## IMPASSABLE TRAUMATIC STRICTURE OF THE DEEP URETHRA

DR. T. TURNER THOMAS gave the history of a man, thirty-eight years old, who was admitted to the University Hospital October 29, 1917. Has always been strong and healthy. January 19, 1917, while at work in the mines, was squeezed in the pelvic region between two cars. After being in a hospital for thirteen days following the injury, he was operated on but does not know the purpose of this operation, except that a rubber drainage tube was passed from one groin to the other, evidently above and in front of the bladder. He says that he could void urine before the operation by the normal

## PHILADELPHIA ACADEMY OF SURGERY

route fairly well. The tube was removed a week after operation, but on the following day urine escaped from both openings in the groins and ceased to pass by the urethra. The opening in the right groin closed and has remained closed since, but that in the left groin has drained urine periodically since but has not in the last two weeks.

A second operation was performed March 1st, its purpose being to cause closure of the urinary sinus in the left groin and the re-establishment of urination by the urethra. The bladder was opened suprapubically and the urethra through the perineum, a tube being passed from one opening to the other. This was removed eighteen days later under an anæsthetic. Urine passed through the urethra two or three times after this, then ceasing and soon making a new opening for itself in the right buttock. The urine afterward escaped by this opening and that in the left groin.

In July a third operation was performed for the purpose of re-establishing normal urination, only a median perineal incision being made. This attempt also met with failure. At the time of admission to the University Hospital he had for some time been urinating only through the opening in the right buttock and seemed to have good control. He did not soil his clothing and could get to the toilet in time, although he sometimes had to hurry. He voided about every two hours.

Operation was performed at the University Hospital, December 6, 1917. A suprapubic incision was first made, considerable difficulty being experienced in deciding that the bladder had been opened because of its small size, its displacement to the right, and the fact that no prostate or urethral orifice could be detected. A probe passed into the urinary sinus in the right buttock failed to reach far enough to be felt by the finger in the bladder and probably did not get to the bladder or urethra. A No. 26 F. sound introduced by the meatus passed to about the anterior layer of the triangular ligament, a No. 20 a little farther, but it could not be felt by the finger in the bladder. An incision about an inch long was then made in the midline of the perineum to the end of the sound, thus opening the urethra. There seemed to be at least an inch between the end of the sound and the finger in the bladder which was trying to feel the sound through the intervening tissues. With no guide on the inside to indicate the former position of the internal urethral orifice, now probably replaced or closed by cicatricial tissue, the re-establishment of the obliterated portion of the urethra presented difficulty. It was decided to force the end of the sound onward into the bladder and later to maintain the track thus made if possible. For a small distance the sound seemed to be opening up a contracted urethra but for the greater part seemed to be making a new path for itself. The finger could not reach to where the sound came through the mucous membrane, but at this stage and in passing other instruments afterward an assistant by his finger in the rectum determined that the rectal wall had not been penetrated. The sound was then withdrawn and a grooved staff introduced into the bladder, on which as a guide a long-bladed bistoury, with its edge turned downward and



#### BILATERAL RENAL CALCULI WITH ENTEROVESICAL FISTULA

to the right, was passed along into the bladder, thus increasing the calibre of the new opening. A No. 26 metal catheter was then passed and its outer end fastened to the penis, to preserve as far as possible the normal shape and curve of the urethra. The lower part of the suprapubic opening was closed by two silkworm-gut sutures, in the upper part a rubber tube being introduced and fixed by suture. The considerable oozing was controlled by gauze packing, and the perineal opening was also thus packed.

The patient had one chill with a moderate rise in temperature after operation, but aside from this did remarkably well. The suprapubic drainage tube was removed in one week and the urine ceased to escape from it in about two weeks and from the perineal wound in about three weeks. The metal catheter was removed twenty-nine days after operation. It was immediately afterward reintroduced and this was followed by a No. 28 F. and a No. 29 F. sound, showing that the new urethra was easy to follow with such instruments. On the next day Nos. 26, 28 and 30 were passed, the last with considerable distress. These were passed daily for about two weeks and then every two days until the patient was discharged from the hospital December 26, 1917. He left the city soon afterwards and has not been seen since, but he promised to have the No. 30 F. sound passed regularly, twice a week for a time and less frequently later.

#### BILATERAL RENAL CALCULI WITH ENTEROVESICAL FISTULA

DR. ARTHUR E. BILLINGS recited the history of a man, aged forty years, who, since 1906, has had occasional pain in his back, at times with frequent micturition. Since childhood he has complained of an "irritable bladder." In the autumn of 1909 he had a severe kidney attack and, after being confined to bed for three or four days, developed severe abdominal pain, persistent vomiting, and absolute constipation, which was diagnosed as intestinal obstruction by his physician and consulting surgeon. He was relieved of this without operation. Soon after this he expelled gas and he thought a slight amount of fecal matter from his bladder. In 1913 he had another renal attack and was in bed for several weeks; after this he had a cystoscopic examination by his physician and was told that he had ulcers in the bladder, which were probably tuberculous and that one of the ulcers communicated with the bowel. He was admitted to the Pennsylvania Hospital September 25, 1916, with a temperature varying between 101 and normal, for six days, and a moderate leucocytosis. In the meantime he was skia-graphed and large stones were revealed in both kidneys with the bladder and ureters negative. At this time there was tenderness over both kidneys, both were palpable, and the left seemed definitely enlarged, where his pain and tenderness were greatest. A phenolphthalein elimination test showed 13 per cent. for the first hour and 12 per cent. for the second hour. Cultures of his urine showed colon bacilli and *Bacillus pyocyaneus*. A cystoscopic examination and ureteral catheterization was not done because it did not seem wise under the condition. Wassermann examination was negative. Elimination was

## PHILADELPHIA ACADEMY OF SURGERY

encouraged and favored in every way. Supportive and local treatment, consisting of irrigation, etc., was instituted, and benzoic acid was given as a urinary antiseptic, because his urine was persistently alkaline and loaded with phosphates and urates. His lowest point in urinary elimination was 20 ounces in twenty-four hours. On November 16th, his general condition had greatly improved, temperature had been normal for three weeks, leucocytes had dropped from about 24,000 to normal, and his average urinary output was above 60 ounces for twenty-four hours, with considerably less pyuria.

*Operation.*—Under morphia and atropine and nitrous oxide-oxygen anæsthesia the left kidney was exposed through the usual costo-ilial incision. It was very adherent, but was delivered and the cortex split longitudinally, the stones were removed and the wound in the kidney was closed with catgut mattress sutures. The kidney pouch was drained. There was a moderate amount of urinary drainage for the first fifteen or eighteen days. He made an uneventful recovery and was discharged December 12, 1916. He was re-admitted January 26, 1917, after having gained considerable weight and generally improved.

*Second Operation* (February 1st).—Under morphia and atropine and nitrous-oxygen anæsthesia the right kidney was exposed in the same manner as the left and it also was very adherent and there was considerable bleeding both from the adhesions and the incision of the kidney, which was also longitudinal through the cortex. The stones were removed, the kidney was closed and the bleeding controlled with catgut mattress sutures. The pouch was drained as on the left side with a rubber covered gauze drain. On the fourth day after operation his abdomen became greatly distended, with persistent vomiting, and evidences of a mass in the right lower quadrant and the suprapubic region were discovered. At the end of twenty-four hours he had expelled gas and was a little improved. During this twenty-four hours his urinary output was about 50 ounces. On the sixth day he was much improved, the mass disappeared and the situation cleared up with the several bowel movements. On the eighth day he had quite a discharge (2 or 3 ounces) of fæces with a lot of gas from his bladder. This persisted for two or three days, his bladder was irrigated sixth hourly and a continuous catheter kept just within the bladder for a few days and 5 per cent. silver iodide emulsion instilled twice daily. Aside from this his recovery was uneventful and he was discharged March 23, 1917, both wounds having healed and being in good condition.

There was no gross clinical evidence at the time of operation of tuberculosis in either kidney. At this writing he has a slight pyuria, but has not had any further fecal discharge from his bladder, although he thought shortly after leaving the hospital, while acutely constipated, that he passed gas from the bladder. His general health is greatly improved and he has added considerable weight (about 20 pounds).

DR. B. A. THOMAS, supplementing what Doctor Billings had said, re-

#### BULLET REMOVED FROM LEFT LUNG

ported another case of bilateral renal calculi with also bilateral urethral calculi. The case is that of a boy aged twenty-three years, who, his mother said, had passed two stones from the urethra at the age of two years and during his early life he had two attacks of illness which were diagnosed appendicitis. The immediate history of the case is that eight weeks prior to the time he was seen by Doctor Thomas, which was last summer, after having joined the Army, he was seized with a violent attack of left-sided renal colic. That is the side which shows one stone in the lower left ureter. This attack lasted for four weeks, after which he was entirely free from pain until five days prior to the time he saw him when again he had an attack and was admitted to the Polyclinic Hospital. At that time he had considerable suppression of urine; he was extremely toxic. Cystoscopic examination was made and indigocarmine was found to be eliminated on the right side, not until twenty-five minutes. This is the side in which there were the three or four stones. On the left side there was no elimination for that length of time. A urethral catheter was obstructed on the left side at a distance of 10 cm. The patient was losing ground, and was very toxic. It was decided to do only a nephrotomy on the left side which was the side in which there was no function. This was done, but four days later, although for two days there seemed to be improvement, he died, apparently from suppression of the urine. The stones removed were stuck so tightly to the kidney tissue that it seemed almost as if they would break in removing them. Possibly this boy had had renal calculi from the time he was two years of age.

#### BULLET REMOVED FROM LEFT LUNG

DR. GEORGE P. MÜLLER reported the history of a man, aged thirty years, who was admitted to the Polyclinic Hospital October 23, 1917, suffering from a gunshot wound of the left lung. There was a wound of entrance but not of exit. There was some dyspnoea, but no other symptoms, and the physical signs were those of moderate hæmothorax. The patient was not very much shocked, and was rather under the influence of alcohol.

On the following day the X-ray examination revealed the bullet to be in the lower lobe of the right lung. On the same day he developed delirium tremens and was quite ill for about one week, by which time he was suffering from dyspnoea from the increasing effusion in the chest. There was also marked aphonia, but this could not have been caused by any injury from the bullet. There was also a great deal of pain at the suprasternal notch.

Operation was done under ether anæsthesia (open method), October 31, 1917. A long incision was made over the fourth rib and about four inches of this resected. After cutting through the intercostal membrane the pleura was separated up and down for a little distance and then opened, and then the cavity was found to contain 600 c.c. of bloody and serous fluid. The lung was adherent to the diaphragm and was separated from this adhesion with difficulty. The bullet was felt in the lower lobe and the lung was

## PHILADELPHIA ACADEMY OF SURGERY

brought up into the wound and, by squeezing, the bullet made prominent. A small incision over it allowed it to be popped out. The lung was dropped back into the cavity and the pleura, muscles, and skin sutured.

A beginning was made to dry out the cavity, but, as the patient did not do well, this was abandoned. It was not possible to entirely suture the pleura. The patient stood the operation well and, although at times was rather dyspnoëic, this was controlled by drawing the lung into the wound and steadying the mediastinum. The patient made an excellent recovery and six days after operation was up and about the ward.

### A FAT-FASCIA-BONE TRANSPLANT FOR DEFECT OF SKULL

DR. PENN G. SKILLERN, JR., reported the following case:

J. V., male, white, aged thirty-two, tiler, was admitted to Polyclinic Hospital (Case Record No. 32216—service of Dr. George P. Müller) on October 26, 1917. Discharged improved on January 15, 1918.

*History of Present Condition.*—Eighteen months ago—on May 7, 1916—the patient suffered a gunshot wound of head. Immediately upon being shot he had convulsions on left side, involving arm and leg; he then fell upon the floor. The bullet entered the right frontoparietal region and passed backward and downward toward the right occipital bone, against which it lodged: it had not been removed. Three months after the injury—in August, 1916—the first operation was performed: the wound was "cleaned out." The paralysis did not improve after this operation and convulsions continued. Three months after the first operation (six months after the injury)—in November, 1916—the second operation was performed: "a piece of bone was removed." After this operation the convulsions disappeared and the patient began to move the left leg.

*Physical examination* reveals a trephine opening in the right frontoparietal region, which opening is partially filled in around the edge. There is hemiplegia of the left side, excluding the face. There is an intention tremor—the limbs can be moved if the patient contracts other muscles first, and when the limbs move they exhibit marked tremor. The reflexes are exaggerated, including the deltoid, biceps and wrists, knee-jerks and Babinski: ankle-clonus is present. The flexors of the fingers are somewhat contracted.

The skiagram (Fig. 1) showed the bullet to right of and just above the external occipital protuberance and very close to it, resting upon the tentorium cerebelli. The wound of entrance is revealed as an irregularly circular defect in the right frontoparietal region, over the upper portion of the fissure of Rolando: seen through this defect is a cluster of spicules of bone, apparently carried into the brain by the bullet.

The patient wanted something done in an operative way for the following reasons: Up to the time of the receipt of the injury he had been a vigorous, able-bodied man who worked hard at his trade (tiler). With the exception of the left-sided hemiplegia he still retained these pristine physical qualities and brooded over his inability to work. He therefore wanted an attempt





FIG. 1.—Preoperative skiagram orientating bullet in posterior cranial fossa and showing defect in frontoparietal region. Note spicules of bone in brain as seen through the defect—these spicules were carried into the brain by the bullet in its course.



## A FAT-FASCIA-BONE TRANSPLANT FOR DEFECT OF SKULL

made to restore the usefulness of his limbs. He also complained that every time he moved his head he experienced in the back of his neck a creaking sensation, as of two pieces of leather being rubbed together. So, too, the defect in the skull, which he could plainly feel, preyed upon his mind and gave him a sense of insecurity.

A study of these propositions from a surgical standpoint did not offer, in the first instance, much hope in the restoration of the usefulness of the limbs. The hemiplegia was doubtless due to destruction of motor cells in the precentral gyrus with subsequent cicatrix formation in the path of the bullet. The only hope in this direction lay in freeing the brain from scar-tension, by removing the dural scar and as much as feasible of the scar-tissue formation that had filled in the path of the bullet. As to the removal of the bullet, such a procedure from a practical surgical standpoint had no indication: it was merely to gratify the patient's wish and relieve him of the paræsthesia of which he complained that this step was contemplated. As to closure of the skull defect, no objections could be found why this should not be accomplished.

Accordingly, the bullet was removed on November 13, 1917, through an osteoplastic flap. The wound healed uneventfully, and the patient no longer complained of his "leather" paræsthesia. Examination of O.S. after operation showed the vision the same as that in O.D.: the patient did not lose the sight in his left eye, as was predicted by an eminent neurologist in case the bullet were removed.

The second operation was performed twenty-four days after the first—December 7, 1917. As this operation is believed to present a more or less original method of closing a skull defect—original in the preservation of the connection of the deep fascia and fat with the bonegraft—the following details have been extracted from the history sheet.

Horseshoe flap of scalp with base below raised, exposing trephine skull defect and adjacent bone. Scar-tissue raised from brain and freed from edge of skull defect. Brain opposite latter more or less disorganized—surface flattened, no convolutions visible. A dense body was palpated in the brain: this was removed and proved a fragment of bone twice the size of a grain of rice. There was some bleeding—arterial spurts and venous oozing—from the median portion of the wound, but this was controlled by packing. The superior sagittal sinus was not opened. The wound was now packed and temporarily closed with a silkworm-gut suture, preparatory to removing the graft from the tibia.

The upper broad subcutaneous surface of the left tibia close to the tibial tubercle was exposed and cleansed with iodine. A goblet-shaped incision was made over this area, and the skin with a thin layer of subcutaneous fat was reflected. The fat, still attached to the deep fascia and periosteum (including tendinous insertions of sartorius and gracilis muscles), was cut wider than the button of bone to be removed, the excess of soft tissue was gathered into the mouth of a 1½-inch trephine, and the button of bone was re-

## PHILADELPHIA ACADEMY OF SURGERY

moved. The medullary tissue and endosteum were scraped away from the graft. The leg wound was closed.

Going back to the skull, the silkworm-gut suture was removed, as well as the packing. The fat-fascia-bone graft was inverted, so that its medullary surface lay uppermost (*i.e.*, toward the scalp) and its fat surface most deeply (*i.e.*, against the brain). Six interrupted sutures of chromic gut No. 00 were applied so as to secure the edge of deep fascia and periosteum to that of the dura: these sutures were left long. The edge of the skull defect was freshened and drilled in two places at opposite poles, and the graft was drilled in similar manner: sutures of No. 2 chromic gut were threaded in these holes. The gauze packing inserted to control hemorrhage was now removed, and the graft inserted with fat resting against the brain. The retention dural sutures were tied first, and the two retention bone sutures were tied next. The graft fitted snugly in position, there being left a small slit between the graft and the skull defect anteriorly and a smaller one between the graft and the skull defect posteriorly. The scalp flap was now replaced and sutured with interrupted sutures of silkworm-gut. At the close of the operation the patient's pupils were contracted (1-16-inch) and reacted to light; they were of equal size.

*Postoperative Note* (January 15, 1918).—It is now nearly six weeks after the second operation. The bone graft has incorporated itself with the skull. As to motor improvement the patient can move his left arm through a wider range, and the intention tremor has disappeared. The finer movements of the fingers have not returned yet. He is able to move his left leg to limited extent and can walk with a cane.

The advantages of the combined fat-fascia-bone graft in this case are obvious. Fat is the tissue best adapted for contacting with the brain substance and serves the double purpose of controlling hemorrhage from the latter primarily and later of preventing adhesions between the cortex of the brain and the sutured duraplasty area. The deep fascia and periosteum are tissues homologous with the dura in structure and in function. The endosteum and medullary substance were removed from the graft to prevent bone formation beneath the scalp. By maintaining these three layers of tissue still connected and in normal relationship with one another favorable conditions of nutrition could be early and readily established.

The following extract, culled from the literature of war surgery, is of interest in connection with this case:

C. Villandre, writing upon the repair of cranial defects (*Presse méd.*, 1917, 300), has, during ten months, personally operated upon 106 cases of loss of cranial substance. The procedures employed were: (1) cartilaginous cranioplasty; (2) osteoperiosteal grafts taken from the tibia; (3) sterilized bone plaques; (4) paste composed of carbonate and phosphate of lime for small breaches.

The statistical results of the four procedures are as follows: Osteoperiosteal grafts, 32 successes in 32 cases, or 100 per cent.; cartilaginous cranio-



## A FAT-FASCIA-BONE TRANSPLANT FOR DEFECT OF SKULL

plasty, 46 successes in 48 cases, or 96.8 per cent.; sterilized bone plaques, 18 successes in 22 cases, or 81.8 per cent.; lime paste, 2 successes in 4 cases, or 50 per cent.

A graft of living substance—bone or cartilage—removed from the patient himself and at a distance from the site of the loss of substance, is therefore the most practical and the surest method of repairing a loss of cranial substance.

As regards the question of ablating portions of the altered cerebral cortex we cite from the following not dissimilar case of Kalb (*Deutsche med. Wchnschr.*, 1917, No. 5), which was that of a boy fourteen years old who for ten years had been epileptic. There was a history of infantile cerebral paralysis. In the pre- and postcentral gyri there were numerous brown-red patches of infiltration containing in certain parts small cysts.

"As complete extirpation of the altered zone would have resulted almost certainly in total paralysis of the right limb, I dissected out from the altered parts small islets varying in size from a lentil to a pea and for a depth of 5 mm. About a dozen such were removed, constituting about two-thirds of the altered parts of the grey matter. Islets of normal cortex remained. There was some language disturbance following operation, but after a week this as well as the limb paralysis improved. After four weeks the patient could walk with the aid of a cane. After one year and a half psychic phenomena have disappeared; the general intelligence is better and the patient can walk for some hours."

DR. CHARLES H. FRAZIER remarked that cranioplasty was one of the most popular topics of discussion in the surgery of the war zone. Many articles are to be found in literature bearing upon this subject. The points which are of principal interest to the surgeons of the war zone to-day seem to be (1) as to whether the defect should be repaired; (2) when it should be repaired; (3) how it should be repaired.

Whether the defect should be repaired depends to a large measure upon its size. Apparently there is a unanimity of opinion that if the defect be large it should be repaired. Many patients so afflicted have a great many subjective phenomena, as in the case just reported by Skillern, which they attribute to the presence of the defect. There are a few surgeons and a few neurologists who are disposed to believe that in epilepsy it is wiser to leave the defect alone, on the ground that anything which tends to increase intracranial pressure acts as a predisposing factor. This phase of the subject is too large to dwell upon here. Suffice it to say that there are two schools, one which believes that epilepsy is due to increased intracranial pressure, the other that increased intracranial pressure is an accompaniment but not the cause of the seizures.

Regarding the time at which defects should be repaired, there seems to be an almost unanimity of opinion that operation should not be done until at least eight weeks after the wound has entirely healed. In the speaker's opinion it should not be done for six or eight months after the accident because the incidence of infection is too great when the operation is per-

## PHILADELPHIA ACADEMY OF SURGERY

formed sooner, that is in case of gunshot wounds that were, as most of them are, the seat of infection.

As to how it should be done—this is a matter of comparative simplicity. The repair of defects with bone or cartilaginous grafts is one of the simplest of surgical procedures. He had had a number of cases in his clinic at the University Hospital, and in these he had practised a modification of the technic of the so-called König-Müller operation. The graft is removed from the parieto-occipital region and is composed of the pericranium and outer table of the skull—not the entire thickness of the skull nor the pericranium alone; it is necessary to remove only a thin shell of bone. The graft is transferred to the defect, the margins of which have been previously freshened, dura freed from the margins and in some instances removed. In the course of six or eight weeks one finds consolidation at the site of the defect complete.

With regard to the technic which seems to be popular in the war zone, particularly with the French surgeons, cartilage is used rather than bone. Cartilage does not become absorbed, it does not shrink, it maintains its vitality and merely changes its residence from one part of the body to another. The supply is secured from the cartilage of the ribs. Some surgeons have taken bone grafts from the tibia or scapula, some from the scapula of the lower animals; some have used the König-Müller operation, some of the skulls of those that have been killed in action, others foreign material such as ivory and silver plates.

The points that have been emphasized in the technic are the following: In the first place the graft should be autoplasmic rather than homoplastic or heteroplastic. His results with the bone graft justify the employment of bone, although cartilage may be more readily obtained and answers the purpose quite as well. The defect must be carefully prepared—this includes freshening of the margins, the freeing of the dura from its adherence to these margins. When the dura is incorporated in a thick scar and the latter is adherent to the cortex, he excises it, scar and dura together. The graft should be laid in the defect with its smooth surface toward the brain. Usually he has fixed it in place with a few interrupted sutures through the pericranium. Some surgeons place the margins of the graft between the dura and the bony margins of the defect, some make a trellis-work with catgut sutures passing across the defect. *Hæmostasis* is regarded as a *sine qua non*, and if it is not possible to control bleeding from all sources, a drainage tube should be used. Some surgeons recommend the exposure of the defect with a crucial incision, although he prefers a horseshoe-shaped flap.

The results of cranioplasty, from the standpoint of the repair of the defect, are almost universally good. He had seen reports of cases where, in removing the graft from the tibia, the latter has been broken or the wound became infected, but these are complications that should have been avoided. Insofar as the operation affects the relief of such symptoms as headache, dizziness and the like, possibly more than half of them are successful. Statistics vary as to the influence of the operation as a prophylactic or in relieving epilepsy. On the whole, reports more than justify the undertaking.

## EDITORIAL COMMENTS

### LUMBAR PUNCTURE AS APPLIED TO CRANIOCEREBRAL SURGERY\*

IN all cranial traumatisms accompanied by cerebral symptoms, lumbar puncture reveals at once by the presence or absence of blood the existence or non-existence of a craniocerebral lesion.

In meningeal affections an examination of the cephalorachidian liquid with reference to its chemical composition, cytological and bacteriological elements, gives important information as to various morbid states of the central nervous system and its envelopes.

For these reasons the author, Dr. F. Albert, believes lumbar puncture to be a diagnostic resource reliable and valuable. The researches of the author have been done at the Military Hospital of Hoogstaede, Belgium, under the direction of Professor Willems. His conclusions are supported by a large number of clinical observations. The most important of his conclusions may be summarized as follows:

1. In all doubtful cases of fracture of the skull or of intrameningeal hemorrhage, lumbar puncture, by the character of the cephalorachidian liquid removed, will determine at once the diagnosis.

2. Lumbar puncture is capable of determining with certainty the differential diagnosis between simple congestion and irritation as distinguished from local compression of a latent zone of the cerebral cortex.

3. Lumbar puncture constitutes an infallible means of distinguishing simple cerebral hernia from the symptomatic cerebral hernia of abscess of the brain or of encephalitis. Each time that the hernia does not subside completely after lumbar puncture, the inference is conclusive that there is present a foyer of encephalic infection.

4. Every case of cerebral concussion and congestion is always accompanied by excessive secretion of cephalorachidian liquid producing phenomena of congestion. These reveal themselves by the ordinary symptoms of compression. In such cases lumbar puncture is the treatment especially indicated, since it removes at the same time the effect and the cause.

5. Lumbar puncture is the only really efficient treatment of fracture of the base of the skull.

6. All cases of irritation of the cortex and of Jacksonian epilepsy to which no apparent external cause can be given are influenced favorably by lumbar puncture; though it has no direct effect upon the local cause, it may, by diminishing vascular tension, render the local cause inefficient. Every time that the puncture is without effect, one may be sure that there exists a gross cause of irritation and explorative craniectomy should be done.

7. Cerebral hernia may always be made to recede and disappear completely by a successive series of lumbar punctures, if these are resorted to early, before the hernia has contracted adhesions, and especially before it has become fleshy and irreducible. Once such a hernia has been reduced, the author recommends, in order to prevent return, that a secondary suture of the wound should be made with, if possible, immediate cranioplasty.

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\* Abstract from *Lyon Chirurgial*, t. xv (April, 1918), page 328.

## EDITORIAL COMMENT

8. Repeated lumbar puncture to a full degree is the treatment of choice possessing real value in cases of post-traumatic meningitis, even in those due to staphylococcic and streptococcic infection. In such cases of infection advantage will be obtained by association of the lumbar puncture with intrarachidian serotherapy followed by decubitus with the head lowered.

*Technic.*—The author prefers in all cases that the patient who is to be subjected to lumbar puncture should be placed in the sitting posture. The patient is seated on the edge of the bed, with legs hanging over. An orderly sits in front of him and takes the legs of the patient between his legs, so as to immobilize them well. The patient rests his own head against the breast of the orderly and bends his back as much as possible. Whenever the condition of the patient is such as to make the sitting posture impractical, a lateral decubitus is chosen. The area of the puncture is cleansed with ether and iodine.

For the first puncture, the point of election is always between the fourth and fifth lumbar vertebrae. As a guide to this, the spine of the fourth lumbar vertebra is first carefully identified. This may be found exactly in the line which crosses the two iliac crests. The point of this spine being fixed by the index finger of the left hand, the needle is inserted a centimetre to the outside and below. An error which is often committed at this point is to direct the needle too much upward and toward the median line. It is necessary, rather, to press the needle straight forward, deviating very little toward the median line. If one observes this precaution, the needle will pass without difficulty between the laminae and penetrate directly into the subarachnoid space. It is very exceptional to strike against the lamina. No anaesthesia, even local, is ever necessary. A very little practice is required to enable the operator to perform the procedure without the least difficulty even in patients who are the most intractable.

The cephalorachidian liquid is received into sterile graduated glasses. In cases of vascular tension (congestion) as much liquid as possible should be withdrawn. The feeling of the individual should be the guide. As a general rule, these cases support an amount of removal to an astonishing degree (from 30 to 40 cc. and even more). The patient announces himself the moment when it is necessary to stop the removal; that is to say, when he begins to complain of headache. This headache, sometimes quite violent at the moment, passes away after a few minutes with the dorsal decubitus. Most of the patients suffer no discomfort whatever from the lumbar puncture. In cases where the puncture gives exit to a bloody liquid, the indication is to alter the position of the point of the needle so as to determine whether or not a vein has been pricked. In such case, as soon as the needle is withdrawn or is plunged in a little more deeply, the liquid clears up, and by receiving the liquid successively into different glasses, finally a perfectly clear liquid is obtained.

When the case under treatment is one of cerebral hernia, the hernia is to be kept uncovered, simply protected by a layer of sterile gauze, so that an assistant can observe the course of the hernia while the puncture is going on; and the puncture is terminated when the hernia has entirely withdrawn into the cranial cavity.

In the treatment of meningitis, a simple evacuating puncture should be followed by antistreptococcic serotherapy; that is to say, after taking away as large a quantity of the cephalorachidian liquid as can be borne until the patient begins to complain of headache, an intrarachidian injection of the antistreptococcic serum is made and the patient placed in an oblique decubitus position, with the head low, and kept for some hours.

If in the course of a series of punctures it happens that no liquid can be obtained by puncture in the usual place, it will be due to clogging of the needle by a fibrinous clot or by blocking up of the subarachnoid space at that level by fibrinous coagulum. In such case, one should ascend a space and go on as before.



## EDITORIAL COMMENT

### PRESENT-DAY VIEWS OF THE PATHOLOGY OF SYPHILIS\*

In a lecture delivered before the Harvey Society at the Academy of Medicine, New York, December 8, 1917, Professor Alfred Scott Warthin discussed certain recent additions to our knowledge of the pathology of syphilis.

He begins by calling attention to the fact that, until within the past year, the entire literature of syphilis has confined itself to the grosser lesions which were evident in the course of ordinary autopsies. Thus, of 4880 autopsies performed at Bellevue Hospital, which were analyzed by Symmers, anatomic evidence of syphilis is recorded to have been present in only 314 cases, or 6.5 per cent. of the whole. On the other hand, however, in the University Hospital at Ann Arbor, whose clientele is drawn chiefly from a rural population representing middle-class farmers, village storekeepers, mechanics and laborers, of 750 autopsies made during the last ten years, evidences of syphilitic infection were found in 300 cases or in 40 per cent. of the entire autopsy material. It is inconceivable that such a population as that constituting the clientele of the Ann Arbor Hospital should contain a greater proportion of syphilized individuals than do the classes which form the clientele of such a hospital as Bellevue Hospital, of New York.

The difference is explained, however, in the difference in pathologic criteria employed in the two instances mentioned. One represents the results of attention merely to gross pathologic anatomy; the presence or absence of gumma being the chief criterion upon which the conclusions were based. In the latter institution conclusions were based upon the revelations of microscopic pathology, and it is to microscopic pathology of latent syphilis that the lecture of Professor Warthin is largely devoted.

The discovery of the spirochæte pallida, as the etiologic agent of syphilis, at once brought about a change in concepts of the pathology of the disease. This change in our concept of the pathology of late or latent syphilis has resulted in displacing the gumma as the type of that lesion and in demonstrating that the viscera are involved in all cases of latent syphilis, not necessarily by gummatous processes, but by specific inflammatory processes proceeding to fibrous processes that are usually mild in character, but which acquire pathologic importance because of their progressive character.

Taking up, first, cases of congenital syphilis dying before or at birth, the spirochæte pallida may be found often in enormous numbers in the heart muscles of such subjects, producing by their colonization focal fatty changes in the myocardium and a specific type of interstitial myocarditis. Spirochætes are often present in great numbers in the tissues of congenital syphilitics in which the changes noted have not been produced.

In cases of acquired syphilis, lymphocyte and plasma-cell infiltrations were associated with spirochæte localizations, although they were not so readily demonstrated in the tissues and organs of known cases of acquired syphilis, aortic aneurism, tabes, paresis, etc., nevertheless, their presence was demonstrated successfully in such a large number of cases as to make the specific syphilitic nature of these lesions certain.

In the progress of these studies, the specific inflammatory lesions of spirochæte localization have been found in the myo-, endo- and pericardium, the aorta, the pulmonary and other large arteries, nervous system, liver, pancreas, adrenals, testis, prostate, prevertebral and mesenteric tissues. These lesions vary greatly in size, from minute collections of a few cells to larger infiltrations visible to the naked eye. Every stage of development from the early active lesions to complete healing and fibrosis was

\* American Journal of Syphilis, vol. ii, No. 3, 1918.

## EDITORIAL COMMENT

observed, but no cases were found in which there were no active lesions. Complete healing throughout the body was never observed. The marked tendency of the lesions to undergo fibrosis and healing with the formation of dense hyaline scar tissue was a striking feature. This tendency may be regarded as an evidence of the relatively avirulent character of the organisms.

The author proceeds to an examination of the lesions found in the different tissues of the body. In the nervous system the most constant changes were those found in the meninges. In practically every case of latent clinical syphilis autopsied some degree of thickening of the meninges was noted. The occurrence of active lymphocyte and plasma-cell infiltration in the meninges in old latent cases of syphilis seemed to parallel the degree of activity of the lesions found in the heart, aorta and other tissues. In general, however, the author believes that probably every case of old syphilis will present in the brain and cord the same scattered perivascular infiltrations of lymphocytes and plasma cells found in all other organs and tissues. Such infiltrations represent simply the local reaction to the presence of spirochætes. Their relations to paresis and tabes may be simply one of degree; the symptoms of the diseases named being dependent upon the amount of destruction of nerve tissue and the consequent functional disturbances produced.

The heart in every case showed microscopic lesions characteristic of spirochæte localization. The cardiac lesions vary greatly in degree. In many cases no fibroid changes were visible to the naked eye, and the occurrence of fibrosis and active infiltrations was determined only by the microscopic examination. It must be emphasized that the determination of cardiac syphilis is essentially microscopic. Even though no myocardial changes may be seen by the eye, the microscopic examination may reveal the most extensive lesions. This is especially true of the more acute and active cases.

The essential lesion of cardiac syphilis is an interstitial myocarditis characterized by infiltrations of lymphocytes and plasma cells along the vessels between the muscle fibres. The entire heart wall, from epicardium to endocardium, including the papillary muscles, may be involved in the infiltrations, but in the average case they lie nearer to the endocardium, often just beneath it, or in the middle layer of the myocardium. In the great majority of cases the myocardium shows healed fibroid areas in association with active infiltrations.

A progressive fibrosis of the myocardium always takes place. In the great majority of cases of latent syphilis the left ventricle was dilated, and such dilatation was either the chief or accessory cause of death. The fibroid heart is the ultimate outcome of all cases of latent syphilis.

Likewise, in the aorta the gross appearances are no absolute criterion of the aortic condition. Whenever the picture is that of arteriosclerosis no positive exclusion of syphilis can be made without a microscopic examination. The aorta may present no changes, or very slight ones, to the naked eye, but the microscopic investigation may show characteristic plasma cells along the vasa vasorum of the media and adventitia. The cases recognizable by the naked eye as syphilitic aortitis are old cases. Similarly, in cases of latent syphilis careful examination may show active areas of plasma-cell infiltration in the tissues of the pancreas, liver, adrenals and testes, the spirochætes can be demonstrated in the active cellular infiltrations similarly in other organs and tissues of the body.

The pathologic lesions as described are common to all cases of old syphilis (secondary stage onward). They were found not only in known active cases of late syphilis, but also in cases with a history of the disease which had been treated and regarded as cured, in cases with negative and in cases with positive Wassermann reactions. In the great majority of those cases in which, upon autopsy, were found

## EDITORIAL COMMENT

to be present these conditions, no history had been presented and no clinical signs or symptoms had been interpreted by clinicians as indicating syphilis. Probably many of those patients never knew that they had syphilis, the infection being either congenital or accidental. The symptoms predominating had not been such as were likely to arouse suspicion of any relationship to an old syphilitic infection.

The conclusion of the author is that syphilis as a latent infection is very much commoner than is generally supposed, and that the proportion of syphilitics in our ailing class is very high. As to the proportion of that class in our population, he believes that the previous estimates of from 5 to 15 per cent. are all too low. He himself would place the incidence of syphilitic infection in this country as nearer 30 per cent. He says that an analysis of our vital statistics will show that at a very low estimate about one-tenth of the deaths occurring in the United States can be attributed to syphilis. Death is rare in the first two years after infection. The incidence of syphilitic death increases progressively with the years after infection. It is particularly the cause of death in millions between forty and sixty years of age, and since its symptomatology at this stage is in the majority of cases either myocardial, vascular, renal, hepatic, etc., it is not recognized clinically as syphilis.

As to curability, Warthin says that he has never seen, pathologically, a cured case of syphilis. In all cases examined at autopsy active areas of specific inflammation are always seen, and such areas mean always the persistence of the spirochæte. Perhaps these intratissue parasites should in cases without symptoms and negative Wassermann reaction be regarded in the same light as that in which we look upon the streptococci of the mouth cavity. Does the spirochæte cease to be a cause of disease and the body become a carrier of relatively or even quite completely harmless organisms? That some progressive injury is being caused is demonstrated conclusively by these studies. Immunity to the spirochæte pallida, and probably to all other organisms that enter the body tissues, or, perhaps, even its passages and cavities, is paid for with a price—the price of defense. The infiltrations of lymphocytes and plasma cells in themselves may cause damage—infinitesimal, perhaps—but when persistent over a period of years may finally produce functional disturbances. The persistent slight damage and necessary repair of fibroplastic proliferation and the eventual fibrosis explains the latent period of syphilis and final outcome in such terminal conditions as aortitis, myocarditis, pancreatitis, etc. The majority of cases of syphilitic infection die from the results of these slow, mild inflammatory processes in the viscera and blood-vessels rather than from paresis or tabes. Doctor Warthin is convinced that the great majority of all cases infected with syphilis die of *chronic myocarditis*.

The syphilitic is always pathologically "damaged goods"; and the damage is a progressive one. He wears out sooner, his viscera more quickly reach their histogenetic limits, he actually becomes prematurely old, and there is a constant strain upon his defensive powers. All of these are arguments for the prevention of syphilitic infection rather than for its cure. No man who has acquired syphilis, though he may become clinically cured (which, as far as we know, means latency of the infection; that is, spirochæte carrying), can have the same potential body-value and expectancy of life as before the infection.

This pathologic conception of the syphilitic as probably always a spirochæte carrier, once the infection is acquired, should influence the therapeutic management of this chronic infection. The syphilitic, even when apparently perfectly well, should have his life laid out for him along lines tending to prevent the reawakening of the virulence of the organisms or an increased susceptibility of the body tissues and organs. This is done for the patient who has once had clinical tuberculosis; when properly treated his future life is planned to prevent the reawakening of his infection, because he, too, is usually, if not always, still a carrier of the infective agent

## EDITORIAL COMMENT

But in the case of the syphilitic, such hygienic measures are not applied, implicit reliance is usually placed upon a certain amount of salvarsan or mercurial treatment, while the infected individual is permitted to take up his life again as if he were an ordinary individual, and, as a rule, he succumbs prematurely to the stress and strains incident even to ordinary living. The treatment of syphilis, as it is ordinarily carried out, looks only to the present moment; it should look to the whole future life of the infected individual.

Syphilis tends to become a mild process; but at any time the partnership between the body and the spirochæte may become disturbed, and tissue susceptibility or virulence of the spirochæte become increased so that the disease again appears above the clinical horizon.

The pathologic diagnosis of syphilis is essentially microscopic. Only in a relatively small number of cases are the gross lesions (tabes, gumma, aortitis, etc.), typical enough to be recognized by the naked eye. A negative diagnosis of syphilis cannot be given with any certainty without a routine microscopic examination of all organs and tissues, but particularly of the left ventricle wall, the aorta, both its arch and abdominal portion; the testes, pancreas and adrenals.

## THE SURGERY OF GUNSHOT INJURIES OF THE THORAX

DURING the past year under the auspices of the American Red Cross in France a Medical Research Society has been maintained at Paris for the benefit of the medical officers of the American Expeditionary Forces. Meetings have been held by this society every month, with an average attendance of about 200 medical officers representing the various hospitals and divisions of the American Expeditionary Forces. These meetings have proved to be in the highest degree practical and helpful, not only in stimulating and correlating the experience of the American medical officers, but also in bringing them into a closer acquaintance and more cordial relationship with their French and British confrères.

The proceedings of this society are being published in monthly numbers under the title of *War Medicine*. The publication is to be edited by Major Seale Harris, M. R. C. The first number, bearing date of August 4, is now before us. It contains the report of the papers presented before the society at its meeting of June 28 and 29 last. The theme under discussion was wounds of the chest. Of the important papers presented we subjoin the following digest:

COL. P. B. SOLTAU, R. A. M. C., said that chest wounds formed on an average  $2\frac{1}{2}$  per cent. of all casualties admitted to the casualty clearing stations, and on occasions the number had arisen to  $3\frac{1}{2}$  per cent. The mortality calculated from the returns made from the British front during the fighting in 1917 was, at the field ambulance stations, 7 per cent.; at the casualty clearing stations, 17.18 per cent.; at the base, about 6 per cent.

The causes of death were two-fold, anatomical and septic. The anatomical causes included gross lesions, with profound shock and hemorrhage; the complicating lesions involving abdomen and other areas, the multiple wounds, and deaths from œdema of the lungs and asphyxia.

In the field ambulance zone the death rate was due entirely to anatomical causes. In the casualty clearing stations it was due to both anatomical and septic causes, while at the base it was entirely septic in origin.

The septic causes were due to infecting organisms of various types, namely, gas-forming organisms, 48 per cent.; streptococcic, 40 per cent., and lung organisms, 12 per cent. The streptococcic infections were the most fatal. The septic death rate in the casualty clearing station area was about 26 per cent. of all deaths. Of every 100 men wounded in the chest, about 9 die of sepsis. This is the death rate which surgery has the greatest hope of reducing.



## EDITORIAL COMMENT

*Types of Wounds.*—The character of the missile was naturally responsible for a great variety of wounds. Large shell fragments would smash many ribs, lacerate the parietes extensively and destroy a large area of lung. Shell fragments of whatever size were more likely to be retained inside the thorax than were bullets. Bullet wounds might also vary greatly in degree. A perforating bullet might traverse the lung and yet cause no discoverable lesions. At times, on the other hand, most extensive injuries were seen from such bullets. This was due partly to the oscillating movement of the bullet, which, in addition to its forward movement and its rotation around the long axis, imparted by rifling, had potential rotation around its short axis, most marked at the early and late stages of the flight, and made active whenever the missile encountered resistance. This short-axis rotation was responsible for many of the so-called explosive effects.

*The Nature of the Injuries.*—(a) To parietes: All degrees of muscle-and-bone injury may be met with. The muscles of the shoulder girdle were liable to gas infection; wounds in that area needed most careful watching. "Stove-in" chest was a term applied to a chest in which many ribs had been fractured and fragments had been driven into the pleura. This formed a most dangerous wound and one that until recently has been nearly always fatal. In such a desperate condition operative measures were justified, however, as constituting practically the only hope, for even if the patient survived the initial shock, fatal sepsis nearly always supervened.

(b) To lung: Lacerations of the lung, hæmothorax and collapse of lung, either singly or in combination, were the conditions met with. As regards the injury to the lung, the most common condition was infarction along the bullet track. Sepsis in the wounded lung was not very frequent, as that organ had a remarkable power to deal with infection within its substance. As to cases of hæmothorax, in the majority of cases blood was poured into the pleural cavity from the lung and not from torn intercostal vessels. Collapse of the lung was an almost invariable condition.

With regard to the pneumothorax, there was one condition requiring emphasis, namely, that known as the "sucking wound," where air was being drawn in and out of the pleural cavity through the wound. The constant variation of intrathoracic pressures and the oscillations of the mediastinum, in this case caused profound shock and rendered the patient very prone to sepsis. It was imperative to close such a wound at the earliest possible opportunity. Since the adoption of this practice, a great improvement in the results had been seen.

*The Unwounded Lung.*—Particular attention must always be paid to the condition of the unwounded lung, upon which largely depended the fate of the patient. Frequently there was observed an area of collapse, which varied in degree from a partial deflation to a massive collapse of the lower lobe. Contralateral bronchitis and œdema were also very frequent. Stress was laid upon these conditions, as their existence was a bar to operation.

*Shock.*—Chest wounds are liable to be accompanied by profound shock. These wounds are pre-eminently the wounds in which a production of acidosis was favored. This was due to pain, exhaustion, diminished oxygenation, forced respiratory movements and impeded circulation.

*Treatment.*—The speaker called attention especially to the following points: Combating of shock by careful warming; the relief of pain by morphine or its derivatives; the securing of a comfortable position for the patient; the suturing or plugging of an open wound; the evacuation of the case to a casualty clearing station as soon as the primary shock is overcome.

At the casualty clearing station the first essential is to secure rest, with immediate examination confined only to determining whether there is bleeding or a sucking wound. The more detailed examination is to be postponed for some hours, when an exact diagnosis as to the condition present should be made with X-ray localization

## EDITORIAL COMMENT

of foreign bodies. Sepsis is to be continually watched for. Large hæmothorax accumulations should be relieved by aspiration, which is best done about forty-eight to seventy-two hours after wounding. As regards surgery, the large open wounds or the "stove-in" chest require plastic repair and closure. Large retained foreign bodies should be removed after accurate localization. The infected chest should be treated either by cleansing and closure or by drainage.

*Evacuation.*—This is a constant problem, especially in times of active fighting. In quiet times it is better to evacuate the straight-forward cases either at the end of three days or to wait until after ten days. The intervening period is the time when sepsis appears, and it is better not to let cases travel during the period. In rush times, however, all wounds unaccompanied by an extensive parietal injury, in which the hæmothorax is not excessive, may be evacuated within twenty-four hours, provided the primary shock is overcome. After operation cases should be retained for at least ten days. The open or draining chests travel badly. Cases should not be evacuated within twenty-four hours after aspiration.

Surgical treatment concerned only a small portion of the cases. In these the highest skill was necessary, and for the remainder the painstaking care of the physician was needed.

### EARLY OPERATIVE TREATMENT IN CHEST SURGERY

MAJOR A. L. LOCKWOOD, R. A. M. C., premised that the complete intrathoracic operations which he was about to describe should be undertaken only in cases likely otherwise to prove fatal. In the earlier years of the war an expectant treatment of chest wounds prevailed, and even excision of the parietal wound was not undertaken unless it was badly infected. It was soon recognized, however, that chest wounds involving the diaphragm and abdomen demanded immediate operation; that the repair of the diaphragm was observed to be more urgent than that of any abdominal viscus, and that, in general, operation should be undertaken as early as possible. In 1916 repair of the diaphragm by the abdominal route became a routine procedure. The procedure finally evolved included excision of the parietal wound and removal of fragments, and, when possible, closing of the pleura. No attempt was made to clear the hæmothorax, or to follow the missile or to repair the thoracic content.

When it was found that, even without sepsis, death resulted usually from badly comminuted parietal fractures, it was made a routine practice to operate immediately all "stove-in" chests.

The treatment of thoracic wounds of the diaphragm is best conducted by the thoracic route.

In the case of sucking wounds, which had previously proved invariably fatal, it was found practicable to excise the parietal wound, clear out the hæmothorax and close the chest wall. As soon as the leakage is stopped, great improvement is at once apparent and the lung tends to expand.

For resuscitation, the patient is placed, if possible, with the injured side dependent. Continuous rectal installation of a 5 per cent. each of soda bicarbonate and glucose in water is started. An intravenous soda bicarbonate 2 per cent. solution may also be given. In severe cases blood transfusion (600 to 800 c.c.) is administered. Hot drinks by mouth, but no stimulants, should be given. Sleep should be induced by every possible means, including morphine. Dyspnoea from hæmothorax or pneumothorax should be relieved before operation by aspiration.

The most perfect operative conditions are essential to success. The following rules are the result of experience:

1. Operate as soon as patient's condition allows.
2. Operate when injury to the diaphragm is suspected.
3. Operate when evacuation will not be necessary.
4. Operate in all cases of open pneumothorax.

## EDITORIAL COMMENT

5. Operate on all badly "stove-in" chests, even if there is no external wound.
6. Operate in all cases where a large missile has traversed the pleural cavity, wherever it may be lodged.
7. Operate on all badly infected wounds, even if the missile is not retained.

Most complete and constant X-ray investigation is necessary. Full sized stereoscopic plates should be taken. Early operation on cases showing signs of bronchopneumonia on the uninjured side must not be undertaken lightly and only with local anaesthesia.

The operative theatre should be heated uniformly to 80 degrees F. Perfect asepsis should be maintained.

The local anaesthesia should be preceded by a preparation of the skin with a 3 per cent. alcoholic solution of picric acid. Novocain 5 per cent. and potassium sulphate 0.25 per cent. in a normal freshly prepared saline is used for the local anaesthetic. To this solution 10 minims of adrenalin per ounce are added just before use.

Paravertebral anaesthesia is administered two or three spaces above and below the wound. A local infiltration at some distance from the wound is employed.

The most serious cases may be operated on with a light nitrous oxide analgesia. Nitrous oxide gas and oxygen should be available for administration when the hand is inside the chest or when the patient is restless. Local anaesthesia combined with gas and oxygen is the best means of preventing shock in extended operations. Neither ether nor chloroform should be used in chest surgery.

When the position of the wound permits, resection of the fourth rib from the midclavicular to the posterior axillary line furnishes the easiest access to the thoracic cavity. Resection of the ribs should be wide enough to allow full and careful inspection of the cavity. Doyen's periosteal elevator and costotome are the instruments best suited for resection of the rib. Tuffier's retractor is useful.

The thoracic cavity must be mopped out with gauze wrung out of hot saline carried on a long curved forceps of the Ochsner pattern. When a missile has pierced the diaphragm and entered the liver, the diaphragm must be excised widely enough to expose the tract in the liver, and the missile removed. The liver tract should be cleansed with Volkmann's spoon, followed by swabs wrung dry out of saline and ether.

If oozing occurs, deep catgut sutures should be inserted with a blunt needle. Mattress sutures suffice to close the diaphragm except when it is stripped from its parietal attachment. The diaphragm, however, need not be sutured to the chest wall.

It is wise to deal with abdominal wounds after the closure of the chest.

Partial lobectomy may be necessary, depending on the degree of laceration of the lung. Total lobectomy and excision of both middle and lower lobes of the right lung have been done for acute malignant gas gangrene, but it has not saved the patient's life. An open bronchus is rarely found at operation. Crushing and ligaturing with catgut is sufficient.

The visceral surface of the lung should in all cases be approximated, thus mechanically retarding effusion from the damaged lung, and lessening the tendency for infective conditions to light up in the lung substance itself. Hemorrhage from the lung need not be feared.

All foreign bodies and blood clots should be removed from the thoracic cavity. The toilet of the pleura can better be performed by sponging (as in the case of the peritoneum) than by washing out. The last step before closing out the peritoneal cavity is to sweep round the chest wall, lung, mediastinum and diaphragm systematically with swabs wrung dry out of hot saline, and, finally, with a swab wrung dry out of warmed ether.

The chest should always be closed, unless there is extensive gas gangrene of the lung tissue itself adherent to the chest wall. Time should not be wasted in attempting to repair the parietal pleura in extensive wounds, as it can rarely be done; such pleura

## EDITORIAL COMMENT

as remains can be caught up with the muscle sutures. The chest must be hermetically closed with the first layer of muscles, otherwise pocketing will occur, pleural effusion accumulate, the incision break down and the operation fail. From the time the pleura is opened until it is closed, when the hands of the operator are not actually in the chest, the hole in the pleura should be covered by thick lint, wrung dry out of hot saline. This closure is important, even if only for a moment at a time. Careful approximation of the skin edges is necessary to ensure early and absolute primary union.

A wide gauze dressing reduces the tension on the sutures and binds the layers of the chest wall so as to prevent oozing and pocketing. A binder made of seven-inch adhesive plaster (tying over the dressing) is valuable to retain the dressing, as well as to relax the tension on the sutures and leave the sound side of the chest free for expansion; the latter is extremely important.

On completion of the operation, the patient should at once be supported in a semi-recumbent position inclined to the injured side.

The two-stage operation is indicated in the type of case with the entrance and exit wounds far apart—front and back or lateral—where gross lesion of the bone or extensive destruction of the tissues necessitates an extensive operation of both wounds. In such a case, enter the chest through the wound which allows freest access to the pleural cavity and to the part probably damaged. After carrying out the operation as outlined above, leave the patient on the table in a comfortable position, surrounded by hot-water bottles. Give intravenous sodium bicarbonate or blood transfusion as required, administer sodium bicarbonate and glucose 8 ounces per rectum. Half an ampoule of omnopon should be given if the patient is at all restless. After one or two hours, deal with the other wound. For the second stage, a further paravertebral anaesthesia is frequently not required—merely local infiltration about the site of the incision.

Injuries of the heart or pericardium can be best dealt with by a parasternal flap of the fourth and fifth, or the fifth and sixth, costal cartilages, depending on the probable site of the lesion (the divided cartilages unite rapidly), and this route, in addition, gives free access to the pleural cavity.

Where the missile has passed across the pleural cavity and lodged in the mediastinum, especially high up, it is wiser to enter the mediastinum through the sternum. The missile should be removed, its bed and track thoroughly cleaned and the pleural opening closed to prevent any leakage from the mediastinum into the pleural cavity. This serves a double purpose—it obliterates a pocket in which pleural effusion might accumulate, and shuts off from the pleural cavity a source of reinfection. It is difficult to deal with the mediastinum through the usual costal incision.

Gross lesions of the parietes under the scapula are always difficult to reach. It is possible to deal with such wounds from either vertebral or axillary border.

Above all, speed and absolute asepsis are essential to success. The operation must begin with *excision in toto* of the wound and end with hermetical sealing of the thorax.

In no class of surgery is team work so essential to success. The surgeon, physician, radiographer and anaesthetist should work hand in hand. The theatre nurse should be particularly quick and methodical, knowing each step of the operation, and avoiding delay by having everything prepared in advance and at hand. A postoperative nurse, who has had long experience in the nursing of these cases, is a most important member of the team.

### SECONDARY SURGICAL TREATMENT OF CHEST WOUNDS

DOCTOR TUFFIER said that the surgical operations necessitated by the complications which follow wounds of the chest are relatively few. He divided them into two classes, namely, aseptic complications, which include foreign bodies; hæmothorax, pul-



## EDITORIAL COMMENT

monary sclerosis, and possibly later, pulmonary tuberculosis, and (2) infectious complications, including purulent pleurisy, abscess and gangrene of the lungs.

Foreign bodies should be extracted after the usual process of localization only when they cause functional troubles which can be definitely traced to their presence. When the foreign body is aseptic, the phenomena attributed to it, he believed, were due to pulmonary sclerosis. In a great many cases the functional troubles, such as pain, dyspnoea and difficulty in respiration, persist after removal of the body in exactly the same degree as before.

Chronic hæmothorax may present either of two forms—an extensive effusion, or a limited interlobar effusion.

The seriousness of hæmothorax arises not only from its long duration, but from the fact that the corresponding side of the thorax collapses, retracts and brings about a definite deviation of the spine, with diminution of the respiratory field. After a very long time the hæmothorax gives way to a probable sclerosis, or the X-ray reveals a considerable thickening of the pleura, and the physical examination a diminution of the vesicular murmur. It is generally situated at the base and posteriorly.

Efforts to render the prognosis of this condition more favorable have not been very successful. At present the speaker said that he treated all cases very early (within from seven weeks to two months) by pleurotomy, with evacuation of the fluid and wide separation of the ribs, by means of his "separator." If the chest is immobile during respiration and very resistant to the touch, he decorticates it. If, however, the lung is still flexible, he merely opens the wound, thoroughly cleans out all false membranes and closes the incision, whereupon the pneumothorax thus created subsides definitely.

*Limited Interlobar Hæmothorax.*—Only four cases of this condition had come under his observation. Under the X-ray they presented a regular spheroid tumor about the size of a large tangerine orange, absolutely limited, with sharply defined edges, without sclerosis, without condensation of the pulmonary parenchyma and without any apparent lesion of its periphery. After puncture, the cavity collapsed to a great extent.

Pulmonary tuberculosis has been noted in a small number of cases. These he considered to be due to suppuration, to hospitalization, or even to individual predisposition. The tuberculosis often develops in the lung on the side opposite to the lesion. An operation done in one case was perfectly successful.

*2. Septic Conditions, Complications Due to Infection with Purulent Effusions of the Pleura.*—The method of treating cases of purulent pleurisy involves chemical disinfection of the wound, followed by closure of the surgical incision, both in medical purulent pleurisy and in post-traumatic surgical suppurations.

The treatment of pleural suppuration in an unopened cavity comprises three steps: (a) Pleurotomy, (b) Chemical disinfection, (c) Closure.

*First step—Pleurotomy.* There are two kinds of cases to be considered, according to whether the purulent pleurisy is of pneumococcal or non-pneumococcal origin. In the first class a simple intercostal pleurotomy is advocated. The incision is made at the point where the slope is greatest in the superior axillary line. The orifice is enlarged by the "separator," which allows a complete evacuation of the fluid and false membranes to be made.

In the second class of cases, non-pneumococcal, a thoracotomy with resection of a single rib is preferable. It allows of the complete evacuation of all exudates, the inspection of the whole of the pleural cavity and examination of the lung. The exploration of the pleural cavity is important. Should the pleuro-pulmonary fold be found much thickened at any point, that part of the pleural fold should be excised and decorticated. Foci of suppuration completely isolated from the pleural cavity may thus be revealed.

## EDITORIAL COMMENT

The final step should be the insertion of Carrel tubes for disinfection of the thoracic cavity. Seven or eight of these tubes are placed into all the recesses, even the furthestmost, in every direction. They are fixed to the skin by a piece of adhesive plaster.

The chemical disinfection of the cavity is effected by injecting Dakin's fluid through each tube every two hours. The bacteriological examination is made by taking a swab once a day from the discharge at three points, the surface, the track and the deep recesses. After a period of from nine to thirty days at the maximum, the pleural cavity becomes sterile and the surgical wound is closed.

As soon as sterilization has been effected the incision is to be closed.

*Treatment of Purulent Fistulae.*—Cases in which, after the purulent pleurisy has been opened, a fistula remains, with persistent suppuration. First, a bacteriological examination of the discharge should be made by swabs taken from the three points already mentioned.

The treatment comprises three steps: (1) Débridement and loosening of the pleural adhesions. (2) Chemical disinfection. (3) Closure, which is here quite different from the operative method.

*First step. Loosening of the Pleural Adhesions.*—This follows after full exposure of the pleural cavity has been secured by raising of a rib, preferably the fourth rib, and the débridement of the wound by a proper "separator." The situation, number and character of the adhesions between the visceral and parietal pleura are then observed; they are broken down with the finger. If the cavity is infected, it is necessary to put in a series of Carrel tubes for the purpose of disinfection.

*Second step. Chemical Disinfection.*—This must be carried out with extreme care. In cases of bronchial fistulae, however, it is not well borne. Throughout the period of disinfection the pulmonary inspection is continued daily and methodically. The pleural cavity is measured by the quantity of liquid which can be injected into it, and the rise and fall of the lung is calculated very easily by the difference in volume of the liquid which can be injected during inspiration and expiration.

As soon as the daily bacteriological examinations of the secretions show that sterilization has been obtained (one organism or less in four fields), the thoracic orifice is closed. Before the closure is effected, it is prudent to suspend the antiseptic treatment, remove the tubes and apply a dry dressing to the wound left in position for twenty-four hours. Then three successive swabs are taken from the depths of the wound, from the edges of the wound and from the neighboring skin. If all three remain negative, the sterility of the wound is assured and the wound should be sutured.

*Third step. Partial or Total Decortication.*—When exploration and inspection show the presence of dense, false membrane binding down the lung, the false membrane is attacked at the point of the union of the lung and the chest wall. To do this an opening in the chest wall must be made, large enough to make the manipulation facile. As soon as an entry has been effected between the membrane and lung, for which a bistoury has been used, the false membrane should be peeled back by a suitable spatula. The lung is then seen to begin to expand throughout the pleuro-costal groove.

The pulmonary decortication is then proceeded with, beginning at the outside and proceeding toward the interior, either by median, transverse or longitudinal incision. In certain cases this peeling off can be effected throughout the whole surface and the lung may be seen to expand out of its shell and fill the thoracic cavity. In some cases the decortication may be completed without more serious injury to the surface of the lung than some erosion. When such simple decortication is not possible, the false pulmonary membrane must be removed *en bloc* from all points where it can be separated from the lung without too much tearing. At other points where it is too adherent, it must be thinned down. If absolutely firm adhesions are found, they should be abandoned, as entire pulmonary dissection is too dangerous.

## EDITORIAL COMMENT

If a bronchial fistula is discovered, it should be closed after the method of Lembert. The parietal reflection of the pseudo-membrane may be removed, if it comes away easily; otherwise, it may be left without any inconvenience.

*Fourth step. Closure of the Wound.*—If on termination of the operation the whole of the decorticated surface after simple compression remains dry, the parietal wound should be closed by two rows of stitches. If there is profuse sanguinary oozing from the decorticated surface, a partial closure only of the wound is made and a light gauze dressing to absorb and effect the discharge is placed on the surface of the lung and brought out through the wound. This is left in place for twenty-four hours, after which it is removed and the suture completed.

It is seen that in these methods the tendency of surgery is exactly contrary to that which formerly prevailed. The thorax cage no longer takes the place of importance before the lung; the lung must always be considered before the chest wall. The advantages of methods now in vogue are considerable as regards the functional future of the patient. The lung resumes its normal activity, whereas in the old methods of treatment everything tended to destroy it.

The final results in acute cases give a normal respiration unless at the base of the lung the diaphragmatic costal sinus disappears. In chronic cases the deformation of the thorax remains stationary after one has begun the treatment of the patient. After cicatrization, the side affected of the thorax dilates and the respiratory capacity increases.

### OPERATIVE RESULTS OF EARLY SURGICAL TREATMENT OF WOUNDS OF THE LUNG

DR. PIERRE DUVAL, Consulting Surgeon of the Seventh Army, said that for the last two years he had treated wounds of the lungs presenting serious immediate accidents, external or internal bleeding and opened thorax, by immediate surgical operation on the wound of the lung. For the past year and a half he had operated systematically on certain wounds of the chest to remove foreign bodies (missile, splinters), to clean surgically the wound of the lung (excision, sweeping suture), to clean the pleura and to treat the wound of the chest wall.

Previous experience accumulated in this war, based on 3453 cases, warranted the statement that, without any immediate surgical treatment, the average total mortality of chest wounds reaches 30 per cent., not including soldiers who die before coming under surgical care. The mortality of through-and-through wounds was 21.2 per cent.; of wounds that retained shell fragments, 30.3 per cent.; of wounds with opened thorax, 27 per cent.; wounds with closed thorax, 15 per cent.

Doctor Duval's personal statistics of last year were 161 cases, which included all cases from the field ambulance to the evacuation hospital, all the cases who died without having been operated, all those operated upon for serious bleeding or opened thorax, all those operated systematically and those not operated. Of the entire number twenty-seven died, a mortality of 16.7 per cent.

Of the twenty-seven who died, thirteen were not operated upon. They died soon after reaching the ambulance in such bad state that nothing could be done to save them.

Of the remaining 148 cases who could be treated, fourteen died; mortality, 10.5 per cent. Among these 148 cases, twenty-nine were operated upon in conditions of urgency, either because they were bleeding severely—sixteen cases, nine deaths—or because the thorax was opened—thirteen cases, four deaths; mortality, 44.8 per cent.

Of the remaining 119 cases, 102 were treated medically, because there was no indication for operating. Of these, five developed empyema, with one death, the only death among the 102 cases. The remaining seventeen cases which presented no urgent indication for operation, but which, according to the speaker's experience, would probably have developed infection, were for this reason operated upon immediately after reaching the ambulance, indications for operating being given either by the size of the missile or the injury of the chest wall, fracture of ribs or scapula, or the extent

## EDITORIAL COMMENT

of the intrathoracic bleeding. This prophylactic operation consists in removal of the foreign body, direct treatment of the wound of the lung, removal of blood from the pleural cavity and careful incision of the chest wall.

The results in these seventeen cases were no mortality; twelve complete healings, with six perfect and six very good results. Five cases developed complications, namely, three localized empyema (anaërobic bacilli), one developed an empyema of the general pleural cavity containing streptococci, one developed an abscess of the lung. These five cases healed well after a secondary operation had been performed.

In the speaker's opinion, these complicating infections were due to the fact that the wound of the lung had not been sufficiently thoroughly treated; that is to say, incomplete excision, bits of clothing or splinters remaining in the wound or in the pleura and the missile not removed. All operated cases were looked after clinically every day. Exploratory punctures were done repeatedly to test the fluid bacteriologically. Every four or five days, or more often if necessary, a radioscopical examination was done at the bed of the patient with the mobile X-ray.

In most cases the pneumothorax had disappeared after five or six days and the lung was in close contact with the chest wall. There remained during an average of from fifteen to thirty days a little shadow diffused through the whole lung or localized in one or two places, often in the lower part of the pleura. If there was some fluid, it often disappeared in eight or ten days. It was evacuated as soon as possible when necessary. In most cases thus treated the chest was normal on an average of from fifteen to thirty days; that is, the dilation of the thorax was normal and the movement of the diaphragm completely free. In six cases there remained a slight general opacity of the side, due probably to thickening of the pleura.

If there is infection, it is usually a mild infection. There may be one or two localized pockets in the pleura. Serious generalized infection of the whole pleural cavity should be exceptional.

In general, the impression gained from these cases is that the quality of the healing in these operated cases had been much better than when primary operation had not been done in similar cases.

### SKIN LESIONS PRODUCED BY MUSTARD GAS\*

1. DICHLORETHYLSULPHIDE (mustard gas) is an escharotic, specific in its action upon the epidermis and tissues of corium, particularly upon the endothelium of the vessels.

2. The lesion is a chemical burn unlike that produced by heat, electricity, or the ordinary corrosives, such as sulphuric, nitric, and hydrochloric acids or strong alkalis. Of all these agents, the effects are most closely allied to those of hydrochloric acid, but are much greater in intensity. It differs from a heat burn in the absence of thrombosis, in the greater degree of fluid exudation, in the greater moistness of the affected area and in the fact that the necrosis as shown by the loss of nuclei requires hours, or even days, for its complete development. The coagulated, shrunken and cooked appearance of the tissues in heat burns is not apparent in the tissues of mustard-gas burns.

3. The vessels in the affected area are severely damaged and collapsed and there is a local anæmia in the earlier stages, with a marked fluid exudation and leucocyte migration. The process is non-hemorrhagic and non-thrombosing.

4. In man the necrosis of the epidermis is usually evident in two hours through the hydropic change in the epithelium and early vesicle formation. There is no deep œdema. It is confined to the epidermis and to the papillary layer in the early stages.

\* ALFRED SCOTT WARTHIER and CARL VERNON WELLER in *The Journal of Laboratory and Clinical Medicine*, vol. iii, No. 8, May, 1918.



## EDITORIAL COMMENT

5. In animals the intense and deep œdema is most striking and altogether different from that seen in man. Vesicle formation was not noted by us in animals.

6. The deep penetration of the smallest quantities applied to the surface is a most striking feature. There is an undoubted entrance through the hair follicles, sebaceous and sweat glands.

7. The slowly progressive character of the necrosis is a specific characteristic, the height of the necrosis being reached five to ten days after application. This may, in part, be explained by contraction and death of the vessels with resulting anæmia in the affected area.

8. The painlessness of the lesion is also a marked characteristic. This may be explained by the œdema and degeneration of the nerve endings in the affected portion.

9. In none of our animals was there any conjunctivitis or irritation of the respiratory tract produced by the cutaneous applications. We conclude that there is no evidence of metastasis from the local lesion as claimed by both Meyer and Haldane. We believe that the conjunctival and respiratory lesions are due alone to the direct action of mustard gas, and when animals are protected from the vapor no lesions in these organs will result, no matter how severe the skin burn.

10. Contrary to the statements of certain English and French observers, the admixture of water does not increase the escharotic action, but if the oil is immediately washed away, the lesion is greatly reduced in intensity. Washing within two minutes with tincture of green soap may entirely prevent the lesion or result in only a slight hyperæmia.

11. We believe that the lesions observed in the axilla, between the fingers and toes, around the genitals and between the thighs of men gassed in action are probably due to the greater moisture of these parts from perspiration and the resulting re-solution of the gas.

12. The slow healing is probably chiefly due to the vessel injury and the relatively slight leucocytic demarcating infiltration. In this respect the lesion is strikingly like an X-ray burn of the skin.

## BOOK REVIEWS

**ANATOMY OF THE HUMAN BODY.** By HENRY GRAY, F.R.S. Twentieth edition. Thoroughly revised and re-edited by WARREN H. LEWIS, M.D., Professor of Physiological Anatomy, Johns Hopkins University. Large octavo; cloth; pages, 1396. Lea & Febiger, 1918.

For two generations American physicians and surgeons have been brought up on Gray's Anatomy. The first English edition was published in 1858, and the following year appeared the first American edition. From time to time during the years that followed new editions have appeared. In each successive edition new knowledge which had become the possession of the profession was embodied. The original plan of Henry Gray, however, as regards presentation of the subject has been adhered to. The reviewer, who began his medical study with the first edition of Gray's Anatomy, as he opens this copy of the twentieth edition, realizes that it is the same book, although enlarged and sublimated, but in all essentials the extremely practical book which gave it so great success upon its first appearance and which has kept it a favorite among medical students even to the present day.

Text-books upon human anatomy have abounded during these years since the first edition of Gray was published. Hyrtl, Braune, and Sabotta, in Germany; Sappey and Tillaux, in France, and Quain and Cunningham, in England, are examples of the laborers and authors in the field of anatomy during this period in their respective countries. In America, also, the activity in this field of labor has been noticeable. The volumes of Harrison Allen, of Piersol, and of Gerrish are monuments of industry most creditable to American medicine, and the volumes devoted to surgical anatomy, clinical anatomy and applied anatomy by such men as Deaver, McClellan, Woolsey, Campbell, Eisendrath, and Davis show the zeal and thoroughness with which the practical applications of anatomical teaching have commanded the interest of American surgeons.

Each one of the anatomical treatises mentioned has its special features of value, and might readily be supposed to have lessened very much the interest in the old standard work which supplied the needs of the medical students fifty years ago. That such, however, has not been the case, and the text-book of the fathers still remains the favorite text-book of the sons, is due to the fact that in the repeated editions and enlargements for the introduction of new matter which has characterized the successive editions as they have appeared, the peculiar features of the original work have been retained.

In the present edition it may be noted, in particular, that the sections on the ductless glands and the nervous system have been largely rewritten, a task for which the present editor was eminently fitted.

## BOOK REVIEWS

THE ACTION OF MUSCLES: Including Rest and Muscle Re-education. By WILLIAM COLIN MACKENZIE, M.D., F.R.C.S. Octavo; cloth; pages, 267. New York: Paul B. Hoeber, 1918.

The object of this little book, which may be read through at a sitting, is to call attention to the importance of a proper appreciation of muscle function, with special reference to a more intelligent and successful application of treatment to overcome losses of muscle power following traumatisms and the various paralyses. It is largely based upon observations made at the Military Orthopædic Hospital, Shepherd's Bush, London, of the staff of which the author is a member.

Its careful reading will well repay any practitioner who has to do with the class of injuries involved, which practically means every medical man, for no class of injuries are of more frequent occurrence than those which form the theme of this study.

Especially noticeable are the views of the author upon the subject of muscle rest. He starts with the theorem that the muscle is a part of the nervous mechanism; that the motor nerve and the muscle are functionally interdependent. Both the nerve and muscle are best considered as parts of an original unit; the muscle retaining the power of contractibility for producing motion, and the nerve retaining the power of irritability and of conduction. The practical importance of this relation, too often overlooked, appears at once. In such a disease as poliomyelitis, for instance, where the chief trouble has fallen on the anterior cornual cells of the cord, it is accepted as axiomatic that such cells should be placed at rest, if the inflammation of which they have become the subject is to be most successfully treated. To secure this rest of the anterior cornual calls, it is clear that, primarily, absolute rest of the muscles to which they are related shall be ensured; for with constant irritation of the muscle by faulty position, massage and electricity, the utmost is being done to prevent recovery of the inflamed nervous elements.

Not only is muscle rest the most effective agent for repair of injury or inflammation of either the muscle itself or of the nervous elements with which it is connected; but the position of rest is the physiological basis for the re-education of muscle function.

The author emphasizes the principle that, in the injury of a limb, as from a bullet or shell wound, the first care, apart from antisepsis, etc., of the wound itself would be the immobilization of the muscles. The immediate protection of the muscles by effective rest is fundamental in the treatment of injury of the limb.

This naturally leads to a discussion of what constitutes muscle rest. In determining this, it is important to take into consideration the state of the opposing muscles, and gravitational force as well; for a weakened muscle must not be allowed to be stretched and irritated by the contraction of its opponent; nor must the weight of an unsupported limb be allowed to exercise a constant dragging on a weakened muscle. Each muscle and

#### BOOK REVIEWS

group of muscles, therefore, becomes the subject of especial study in the therapeutic application of this principle, and to the application of this principle to the different muscles of the body the greater part of the book is devoted. For it is by position with adequate immobilization that the deformities of limbs produced by chronically contracted muscles working against weakened opponents are to be overcome. Thus deformities due to muscle weakness may always be prevented.

The author condemns positively *brisement forcé*. In his view, the breaking down of muscle contraction, like the "smashing up" of joint adhesions at one sitting under an anæsthetic, cannot be too vigorously condemned. By such procedure permanent injury is usually done to the muscle.

We commend the study of this little book to all surgeons.



## CORRESPONDENCE

### IODINE AS A SKIN DISINFECTANT PREVIOUS TO INTRA-ABDOMINAL WORK

TO THE EDITOR OF THE ANNALS OF SURGERY:

The keynote of a question is not always easy to strike, even by one qualified to speak. No better illustration of this has come to my notice than a letter published in the ANNALS OF SURGERY for September, 1918, over the signature of A. Ernest Maylard, of Glasgow. The author of this letter would warn us against the "dangerous practice" of sterilizing the abdominal skin by the use of iodine, and substantiates his contention by quoting from a letter recently published in the ANNALS OF SURGERY by Doctor O'Connor, and also from some experiments conducted on dogs by Propping and others.

Doctor Maylard's letter may contain an element of truth, but it is so conspicuous in another element that it should not pass unnoticed. The author of this letter starts out to tell us about iodine as a means of sterilizing the skin, when suddenly he departs from this subject to regale us with the subject of intra-abdominal adhesions, leaving us to guess, perhaps, that between the two there may be some mysterious relation, or that the one is dependent in some way on the other.

Doctor Maylard is probably correct in not denying that iodine will sterilize the skin; just as it is correct to state that when iodine is loosely splashed and spilled about over the abdomen, and carried by every stroke of the surgeon and his assistants, by sponges and instruments, to all parts of the abdominal cavity during an hour or two's duration, it will carry with it an element of danger, and leave behind it, as Doctor Maylard rightly says, many dangerous adhesions within the abdomen.

The letter is quite incorrect when it states that iodine is a "veritable death trap," and as a means of sterilizing the abdominal skin is a "dangerous practice." Years of surgical work by thousands of surgeons in civil and military surgery alike have given to iodine a safe place as a therapeutic agent; one which leaves little to be desired in cheapness, promptness and effectiveness in fulfilling the purpose for which it is used. It is safe, satisfactory, and dependable always. Iodine employed on the abdominal skin in the manner below described will render it fit for the surgeon's work under practically all conditions. It is free from danger, and results in no damage, immediate or remote, temporary or permanent, to the tissues or structures within the abdomen. The uncovered and unprotected iodinated skin during any operative procedure is a gross neglect, a glaring defect in surgical technic, and is fraught with danger. The proper use of iodine is safe; its abuse is not safe. The same may be said of any antiseptic,

## CORRESPONDENCE

even of carbolic acid, the most dangerous and unreliable of all antiseptics, and to which Doctor Maylard's faith is still clinging.

Iodine spread liberally upon the abdominal skin as strong as 7 per cent. will effectively sterilize it under all conditions. After making the incision through the skin thus sterilized, the iodinated surface is covered with sterile towels, which are accurately fastened into the skin or wound margins, preventing in this manner any of the iodine, by the operator's manipulations, from entering the abdominal cavity while the operation is going on. These towels are not released until the operative work within the abdomen is finished and peritoneum closed. When the towels are removed the skin shows the same deep iodine stain, proof that it has not been mopped up and carried with every move of the operator into the abdominal cavity, where harm may be done.

In this day of rapid and ever-changing therapeutic measures, as well as operative procedures, a few things have come to stay; have stood the test of time and experience, and are relied on by most men. Iodine, as a means of skin sterilization, is one of these.

With communications such as this, and the one to which it makes reply, should go our humble apologies to the editors of the medical journals, as is here intended, for requesting space and time sufficient to publish that which time has long since fully established and thoroughly settled, and which should not at this late day call for further elaboration, but should make way and room for better things.

WILLIAM FULLER,  
Major, M. C., U. S. Army.

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